



## **Biological Assessment and Stressor Study Report**

**Dardenne Creek  
St. Charles County, Missouri**

**Fall 2014 – Spring 2015**

Prepared for:  
Missouri Department of Natural Resources  
Division of Environmental Quality  
Water Protection Program  
Water Pollution Control Branch

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## **1.0 Introduction**

Dardenne Creek's upper reach has been the focus of past Missouri Department of Natural Resources (**MoDNR**) studies (Campbell 2002, Michaelson 2007, 2009). The Department's Water Protection Program first requested a biological assessment of Dardenne Creek in 2002 to address potential water quality concerns related to increasing development in the watershed. A portion of the 2002 study's findings revealed that the benthic substrate of the downstream study reach was significantly covered with fine sediment, which prompted the MoDNR to add Dardenne Creek to the 2002 303(d) List of Impaired Waters for unknown pollutants originating from urban and rural nonpoint source pollution.

At the request of MoDNR's Water Protection Program (**WPP**), the Environmental Services Program (**ESP**) Water Quality Monitoring Section (**WQMS**) conducted a macroinvertebrate biological assessment and habitat study of Dardenne Creek during the fall of 2014 and spring of 2015 as a follow up to the previous studies (conducted in 2002, 2005, and 2008). During the current study, Brandy Bergthold, Brian Nodine, and Ken Lister collected macroinvertebrate and water quality samples from seven Dardenne Creek stations in St. Charles County in September 2014 and March 2015. Habitat assessments were conducted at the sites in September 2014. As part of a stressor analysis study, multiparameter sondes were deployed at two stations in August 2014 to record dissolved oxygen (**DO**). Benthic fine sediment was estimated during the summer of 2016.

The Dardenne Creek watershed drains approximately 30 percent of St. Charles County and contains many of the quickest growing cities and communities within the county (USACE 2007). As watersheds are developed, much of the vegetation is replaced by impervious surfaces (e.g. roads, parking lots, houses). This conversion reduces the surface area that allows rainwater to infiltrate into the ground thereby increasing the amount of storm water runoff draining directly into surface water (Lazaro 1990; Paul and Meyer 2001). Storm water runoff negatively affects water quality by transporting sediment and pollutants picked up from impervious surfaces into waterways (Lenat and Crawford 1994; Paul and Meyer 2001; Walsh et al. 2005). In addition, storm water often carries water of higher temperatures coming from streets, rooftops, and parking lots. Development affects the quantity and quality of water entering a watershed by altering the natural flow of rainwater, making streams, and rivers more susceptible to extreme flooding events (Lazaro 1990; Tang et al. 2005; Walsh et al. 2005). Aquatic macroinvertebrate communities are directly affected by watershed alterations (Lemly 1982; Paul and Meyer 2001).

## **2.0 Project History**

The 2002 study included macroinvertebrate community, benthic sediment, and water quality analyses at six stations on Dardenne Creek and two stations on North Fork Cuivre River (a control stream located in the same Ecological Drainage Unit [**EDU**]). Water quality analysis included a standard suite of water chemistry parameters as well as testing for fecal coliform. Biological metrics tended to increase on Dardenne Creek from upstream to downstream with the exception of Station 4 near the confluence of Little

Dardenne Creek. One recommendation of the 2002 study was to collect additional samples, at a later date, to determine if the Little Dardenne Creek subwatershed contributed to the decline in biological metrics downstream of the confluence with Dardenne Creek (Campbell 2002).

In September 2005, a second biological assessment study (Michaelson 2007) began to address recommendations in the 2002 report regarding Little Dardenne Creek. This study repeated macroinvertebrate and water quality sampling at Station 3 and Station 4; in addition Station 4.1 was established immediately upstream of the Little Dardenne Creek confluence, as well as a station on Little Dardenne Creek itself. Water quality analyses did not indicate any notable differences in Dardenne Creek upstream versus downstream of the confluence, nor was water quality in Little Dardenne Creek sufficiently different to suggest it was the cause of the macroinvertebrate community anomaly observed in the 2002 study. The biological component of the follow-up study was judged inconclusive due to low water levels during the fall 2005 sample season that extended into the winter months preceding the spring 2006 sampling.

In the fall of 2008, a third biological assessment (Michaelson 2009) was initiated on Dardenne Creek. Seven stations were sampled on Dardenne Creek. Little Dardenne Creek was excluded from the 2008-2009 study. Five local control streams within the Central Plains/Cuivre/Salt EDU were chosen to compare with the Dardenne Creek stations in addition to comparing Dardenne Creek with biological criteria reference stream (**BIOREF**) data. This study included analysis of water quality and nutrient parameters, macroinvertebrate sampling, and evaluation of sediment deposition in Dardenne Creek and the five local control streams. Macroinvertebrate Stream Condition Index (**MSCI**) scores for Dardenne Creek were very similar longitudinally during both sampling seasons and there were no notable differences in water quality or nutrient parameters. Two methods were used to evaluate sediment deposition in Dardenne Creek and the control streams. Both methods revealed a higher percentage of sediment deposition in Dardenne Creek. The overall conclusion when compared with both the control stream and the **BIOREF** stream was that Dardenne Creek is a moderately impaired system, and the majority of macroinvertebrate samples have attained partially supporting status.

## **2.1 Study Area**

Dardenne Creek originates southwest of Foristell in eastern Warren County and flows east through rural St. Charles County, which is interspersed with housing subdivisions. The creek downstream of Highway 40-61 (downstream of the study area) flows through urbanized areas and includes reaches that appear channelized.

One station located in the study reach is located in class “P” waters (those that flow permanently, even in periods of drought) and the remaining stations are located in class “C” waters (those in which flow ceases in dry periods, but permanent pools remain to support aquatic life). The Missouri Water Quality Standards (**WQS**, MDNR 2014f) state the beneficial use designations for the Class “P” portion of the study area of Dardenne

Creek to be “protection of warm water aquatic life, human health-fish consumption; livestock and wildlife watering; category B whole body contact; and secondary contact recreation.” Category B whole body contact applies to waters that are not open to the public or regularly used for swimming. Secondary contact recreation applies to recreational activities that may result in incidental or accidental contact with the water, and the probability of ingesting appreciable quantities of water is minimal. For the Class “C” portion of the study reach, beneficial uses on Dardenne Creek are “protection of warm water aquatic life, human health--fish consumption; livestock and wildlife watering; and category B whole body contact.” Permanent flow of this stream begins in Section 22, Township 46 North, and Range 2 East. Station 1 is the only sample station classified with permanent flow, and stations 2 through 6.1 are classified as class "C" waters.

Dardenne Creek is located within the Central Plains/Cuivre/Salt EDU. An EDU is a region in which biological communities and habitat conditions can be expected to be similar. A map of the EDU can be found in Figure 1. Dardenne Creek is located along the southern boundary of the Central Plains/Cuivre/Salt EDU.

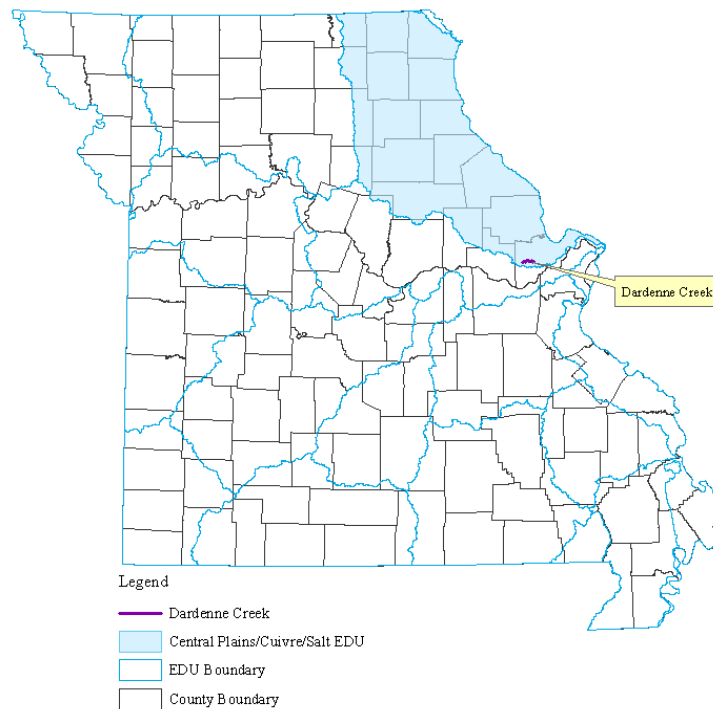


Figure 1. Location of Dardenne Creek within the Central Plains/Cuivre/Salt EDU

The study area includes approximately 10 miles of Dardenne Creek located from the August A. Busch Conservation Area upstream to the Foristell Road bridge crossing, north of New Melle. The test stations were used for previous biological assessment studies with the exclusion of station 4.9. Station 4.9 replaces station 5.0. The 2002 biological assessment was conducted as part of a joint project with the Missouri Department of

Conservation (**MDC**). MDC personnel used Global Information Systems (**GIS**) software (e.g. ArcView<sup>®</sup>) to choose Dardenne Creek stream reaches in a stratified random manner to sample for fish; WQMS personnel used these same stations for biological assessment purposes. A map of the sampling locations can be found in Figure 2.

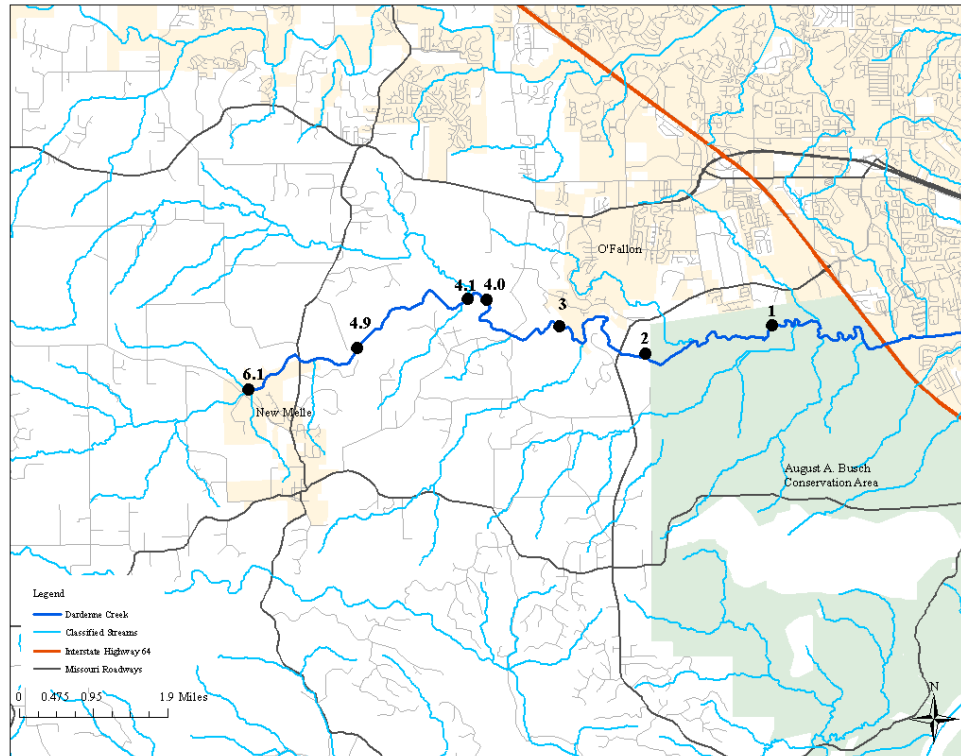


Figure 2. Dardenne Creek Sampling Locations

#### Sampling Locations

Dardenne Creek Station 1 (no legal description) is located north of Lake 33, also known as Kraut Run Lake, in the August A. Busch Conservation Area in St. Charles County. Universal Transverse Mercator (**UTM**) coordinates collected at the upstream boundary of the sample reach are UTMN 4290168, UTME 694133.

Dardenne Creek Station 2 (NE ¼ sec. 21, T. 46 N., R. 2 E.) is located downstream of the State Road DD bridge in St. Charles County. UTM coordinates, measured approximately 200 yards upstream of the Busch Conservation Area property boundary, are UTMN 4289417, UTME 691612.

Dardenne Creek Station 3 (Survey 418, T. 46 N., R. 2 E.) is located downstream of the Hopewell Road bridge in St. Charles County. UTM coordinates, measured approximately 0.7 miles downstream of the Hopewell Road Bridge, are UTMN 4290165, UTME 689656.

Dardenne Creek Station 4 (Survey 891, T. 46 N., R. 2 E.) is located just downstream of the confluence with Little Dardenne Creek. The UTM coordinates of the upstream terminus are UTMN 4290823, UTME 687949.

Dardenne Creek Station 4.1 (Survey 891, T. 46 N., R. 2 E.) is located upstream of the Little Dardenne Creek confluence in St. Charles County. UTM coordinates at the downstream terminus of the sample reach are UTMN 4290690, UTME 687847.

Dardenne Creek Station 4.9 (Survey 1807, T. 46 N., R. 1E.) is located approximately 0.9 miles downstream of the State Road Z bridge in St. Charles County. The UTM coordinates taken near the upstream boundary of the sampling reach are UTMN 4289684, UTME 685539.

Dardenne Creek Station 6.1 (E ½ sec. 22, T. 46 N., R. 1 E.) is located downstream of the Foristell Road bridge in St. Charles County. UTM coordinates were taken downstream of a small wet-weather tributary that entered from the right descending bank downstream of the bridge (UTMN 4288800, UTME 683311). This wet-weather tributary is the receiving stream of a small minor non-municipal treatment facility.

#### Biological Criteria Reference Station

South River Station 4 (NE ¼ sec. 31, T. 58 N., R. 5 W.) is located upstream of the County Road 403 bridge in Marion County. UTM coordinates at the downstream terminus of the sample reach are UTMN 4404764, UTME 628321.

#### Local Sediment Control Stations

North Fork Cuivre River Station 1 (Section Line 13/14, T. 51 N., R. 3 W.) is a control station located downstream of the County Road 325 bridge in Pike County. UTM coordinates are UTMN 4339671, UTME 655693.

Big Creek Station 1 (NW ¼ sec. 34, T. 48 N., R. 2 W.) is a control station located upstream of the North Church Rock Road bridge in Warren County. UTM coordinates at the downstream terminus of the sample reach are UTMN 4305487, UTME 662273.

Hays Creek Station 1 (NW ¼ sec. 29, T. 54 N., R. 5 W.) is a control station located upstream of the Bridgewater Lane bridge in Ralls County. UTM coordinates at the downstream terminus of the sample reach are UTMN 4366407, UTME 629910.

Sugar Creek Station 1 (NW ¼ sec. 31, T. 50 N., R. 1 E.) is a control station located upstream of State Road KK within Cuivre River State Park in Lincoln County. UTM coordinates at the downstream terminus of the sample reach are UTMN 4325210, UTME 677770.

South River Station 1 (SW ¼ sec. 29, T. 58 N., R. 5 W.) is a control station located downstream of County Road 402 in Marion County. UTM coordinates at the downstream terminus are UTMN 4405987, UTME 0629832.



South River Station 2 (SE ¼ sec. 30, T. 58 N., R. 5 W.) is a control station located upstream of a farm machinery crossing, approximately 0.5 miles west of the County Road 402 bridge in Marion County. UTM coordinates at the crossing are UTMN 4405920, UTME 628785.

South River Station 3 (NW ¼ NE ¼ sec. 31, T. 58 N., R. 5 W.) is a control station located downstream of the County Road 403 bridge in Marion County. UTM coordinates at the downstream terminus of the sample reach are UTMN 4404991, UTME 628646.

### **3.0 Objectives**

The objective of this study was to determine if Dardenne Creek supports its beneficial use designation of supporting aquatic life based on biological criteria calculated from reference stream macroinvertebrate data in the Central Plains/Cuivre/Salt EDU. The macroinvertebrate community and the instream habitat were compared longitudinally among the seven Dardenne Creek stations, as well as compared with biological reference stream data from the Central Plains/Cuivre/Salt EDU. Water quality and nutrient parameters were compared longitudinally among the Dardenne Creek study sites and compared with Missouri's Water Quality Standards.

### **3.1 Null Hypotheses**

- 1) Land cover characteristics in the Dardenne Creek watershed will be similar to the land cover characteristics of the Central Plains/Cuivre/Salt EDU.
- 2) Stream habitat assessment scores of Dardenne Creek will be similar to the stream habitat scores of South River, a BIOREF stream in the Central Plains/Cuivre/Salt EDU.
- 3) The macroinvertebrate community in Dardenne Creek will be similar among longitudinally separate reaches of Dardenne Creek.
- 4) The macroinvertebrate community in Dardenne Creek will be similar to the macroinvertebrate community of BIOREF streams in the Central Plains/Cuivre/Salt EDU.
- 5) Physicochemical water quality of the surface water of Dardenne Creek will meet Missouri WQS (MDNR 2014f).
- 6) Benthic fine-sediment coverage of Dardenne Creek will be similar to benthic fine-sediment coverage of the eight control streams located in the Central Plains/Cuivre/Salt EDU.

#### **4.0 Methods**

Macroinvertebrate sampling was conducted during fall 2014 and spring 2015 by the WQMS's Aquatic Bioassessment Unit. Fall sampling was conducted on September 25, 29, and 30, 2014, and consisted of stream habitat assessments, macroinvertebrate sampling, and water quality sampling at seven stations on Dardenne Creek. Additional DO data logger readings were taken prior to fall sampling on August 8-14, 2014, at stations 1 and 3. During the spring, sampling was conducted on March 24 and March 30, 2015, and consisted of macroinvertebrate sampling and water quality sampling at the same seven study stations.

Benthic fine-sediment coverage estimations were conducted on all seven of the study stream stations and eight control stream stations during the summer of 2016. These estimations require steady base flow conditions at all stations to conduct benthic sediment assessments (MDNR 2014c). Persistent high water conditions during most of the study period as well as pooled conditions during reconnaissance and data logger deployment early in the study precluded this procedure from occurring concurrent with the bioassessment.

##### **4.1 Stream Habitat Assessment Project Procedure**

Standardized assessment procedures were followed as described for riffle/pool prevalent streams in the Stream Habitat Assessment Project Procedure (**SHAPP**, MDNR 2010e). According to the SHAPP, there is a relationship between habitat quality and the biological community. Stream habitat quality is scored for each station, and the scores are compared with a control stream (usually a BIOREF) SHAPP score. If the SHAPP score at a test station is  $\geq 75\%$  of the SHAPP control score, the stream habitat at the test station is considered to be comparable to the control stream. South River, located in Marion County approximately one mile east of Palmyra, is a BIOREF stream that was chosen as the SHAPP control. The habitat assessment of South River was conducted on September 30, 2014. SHAPP scores were calculated for the Dardenne Creek stations, compared to the biological criteria reference SHAPP, and examined for notable results.

##### **4.2 Macroinvertebrate Collection and Analysis**

Macroinvertebrate sampling was conducted according to the Semi-quantitative Macroinvertebrate Stream Bioassessment Project Procedure (**SMSBPP**, MDNR 2012a). Dardenne Creek is considered a riffle/pool dominated system. The three standard habitats sampled at all locations were flowing water over coarse substrate, non-flowing water over depositional substrate, and rootmat. Macroinvertebrate samples were subsampled in the laboratory and identified to specific taxonomic levels (MDNR 2014d) to calculate biological metrics (MDNR 2012a).

Dardenne Creek macroinvertebrate data were evaluated relative to the BIOREF streams in the Central Plains/Cuivre/Salt EDU. Biological criteria are calculated separately for the fall (mid-September through mid-October) and spring (mid-March through mid-April) index periods. The SMSBPP provides details on the calculation of metrics and

scoring of the multi-metric MSCI. The four components of the MSCI are Taxa Richness (**TR**); Ephemeroptera, Plecoptera, and Trichoptera Taxa (**EPTT**); Biotic Index (**BI**); and the Shannon Diversity Index (**SDI**). An MSCI score of 16-20 is considered fully supporting, 10-14 partially supporting, and 4-8 non-supporting of the protection of warm water aquatic life beneficial use designation as listed in the Missouri WQS (MDNR 2014f).

#### **4.3 Multiparameter Data Sonde Collection**

A YSI Model 6920 V2 data logger (YSI Incorporated, Yellow Springs, Ohio 45387 [a subsidiary of Xylem Incorporated]) was deployed for a 6-day period during anticipated summertime low-flow periods to measure DO, temperature, and specific conductivity every 15 minutes. Data logger use was conducted following Standard Operating Procedure MDNR-ESP-104 *Continuous or Long-Term Monitoring of Water Quality Using a Dissolved Oxygen, Specific Conductivity, pH, Turbidity, Rhodamine Dye, and Temperature Data Logger* (MDNR 2014b).

#### **4.4 Physicochemical Water Collection and Analyses**

Physicochemical water samples were handled according to the appropriate MoDNR ESP Standard Operating Procedures (**SOP**) or Project Procedures (**PP**). Results for physicochemical water parameters were examined by season and station by field measurements or grab samples collected in accordance with the SOP MDNR-ESP-001, *Required/Recommended Containers, Volumes, Preservatives, Holding Times, and Special Sampling Considerations* (MDNR 2014a). All samples were kept on ice during transport to ESP.

Water quality parameters were measured *in situ* or collected and returned for analyses at the state environmental laboratory in Jefferson City. Temperature (°C, MDNR 2010b), pH (standard units, MDNR 2012b), specific conductance (µS/cm, MDNR 2010c), DO (mg/L, MDNR 2012c), and discharge (cubic feet per second-**cfs**, MDNR 2013a) were measured in the field. Turbidity (**NTU**, MDNR 2010a) was measured and recorded in the ESP, WQMS biology laboratory. The ESP Chemical Analysis Section (**CAS**) conducted analyses for the following: calcium, magnesium, hardness as CaCO<sub>3</sub>, sulfate, ammonia-nitrogen, nitrate+nitrite-N, total nitrogen, total phosphorus, chloride, and non-filterable residue (all parameters reported in mg/L).

Physicochemical water parameters were compared among stations as well as with Missouri's WQS (MDNR 2014f). Interpretation of acceptable limits in the WQS may be dependent on a stream's classification and beneficial uses as designated in the WQS (MDNR 2014f).

#### **4.5 Discharge**

Stream flow was measured using a Marsh-McBirney Model 2000 Flo-Mate™ current meter at each station during both sampling seasons in accordance with the SOP MDNR-ESP-113, *Flow Measurement in Open Channels* (MDNR 2013a).

#### 4.6 Benthic Fine Sediment Coverage Estimation

Percent fine sediment coverage was visually estimated at each sample station (fine sediment is considered to be particle size less than 2 mm) in accordance with SOP MDNR-ESP-115, *Estimation of Benthic Fine Sediment Coverage in Wadeable Streams* (MDNR 2014c). The readings were made at the lower margins of riffle/run habitat where stream velocity decreases and fine sediment tends to drop out of the water column and collect on the streambed.

Each stream reach contained three sample grids with six contiguous transects across the stream. Transects were established and sampled in a downstream to upstream direction. One sample quadrat (25 cm X 25 cm) was placed directly on the substrate within each of the six transects using a random number that equated to one-foot increments (see Figure 3). Two investigators visually estimated the percentage of the stream bottom covered by fine sediment within each quadrat. An average of the two estimates was used for analysis.

This percent coverage was analyzed to determine whether a statistically significant difference ( $p < 0.05$ ) exists among Dardenne Creek stations compared to one another as well as to local control or BIOREF sites. The statistical program SigmaStat<sup>®</sup> was used to conduct statistical comparisons between two groups. For each comparison the normality test failed, which necessitated the use of the nonparametric Kruskal-Wallis Analysis of Variance on Ranks.

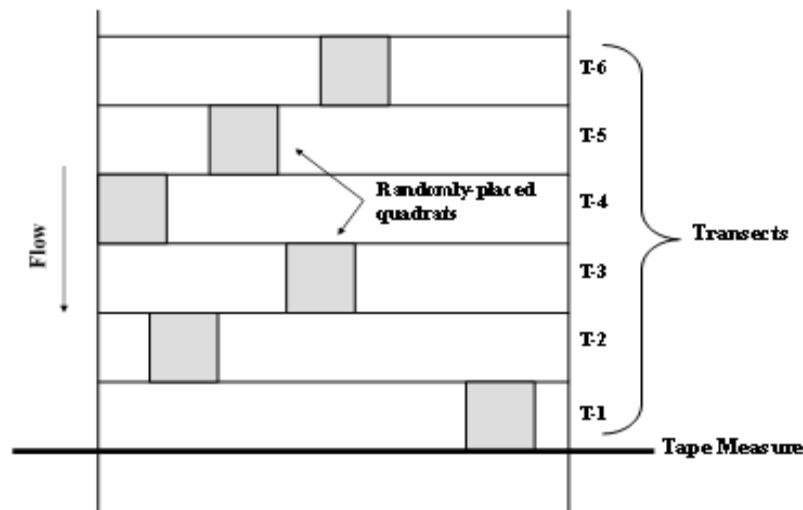


Figure 3. Sediment Sample Grid

#### **4.7 Quality Assurance/Quality Control (QA/QC)**

##### **4.7.1 Field Meters**

All field meters used to collect water quality parameters were maintained in accordance with *Quality Control Procedures for Checking Water Quality Field Instruments* (MDNR 2010d).

##### **4.7.2 Biological Samples**

Steps to assure accuracy of organism removal from sample debris were performed consistent with those methods found in the SMSBPP document (MDNR 2012a).

##### **4.7.3 Biological Data Entry**

All macroinvertebrate data were entered into the WQMS macroinvertebrate database consistent with *Quality Control Procedures for Data Processing* (MDNR 2014e).

##### **4.7.4 Duplicate Sample Collection**

The goal of the sampling protocol is to collect a majority of the taxa with consistent relative abundance from each of three major habitats in a reach of stream. Duplicate samples are obtained from the same location at essentially the same time as the true sample following the same procedures in accordance with *Quality Assurance/Quality Control for Environmental Data Collection* (MDNR 2013b). The true sample and the duplicate sample are analyzed for the same set of parameters. A duplicate is used to assess the precision associated with sampling methodology, sample heterogeneity, and analytical procedures (MDNR 2013b).

A duplicate sample was collected for both physicochemical and macroinvertebrate parameters at station 1 during the fall sampling period. Duplicate samples are analyzed and reported independently. Duplicate macroinvertebrate samples are analyzed for Quantitative Similarity Index for Taxa (**QSIT**), which compares the two samples in terms of presence or absence of taxa and taking relative abundance (percent composition) of each taxon into account (MDNR 2012a). Duplicate samples are expected to have a 70 percent or greater taxa similarity (Rabeni et al. 1999; MDNR 2012a).

#### **5.0 Results and Analyses**

##### **5.1 Land Use**

Table 1 compares the land cover percentages from the Central Plains/Cuivre/Salt EDU and the 12-digit Hydrologic Unit Codes (**HUC**) that contain the reaches of this study's sample stations. Percent land use data were derived from Thematic Mapper satellite images from 2000-2004 and interpreted by the Missouri Resource Assessment Partnership (Sowa et al. 2004).

Table 1  
Percent Land Use Comparison between Dardenne Creek  
and the Central Plains/Cuirvre/Salt EDU

| Dardenne<br>Creek<br>Stations | 12-digit HUC | Non-<br>Vegetated | Crop-<br>land | Grass-<br>land | Forest-<br>land | Herba-<br>ceous | Wetland/<br>Open<br>water | Drainage<br>Area, sq.<br>miles |
|-------------------------------|--------------|-------------------|---------------|----------------|-----------------|-----------------|---------------------------|--------------------------------|
| 1                             | 071100090103 | 3.7               | 29.1          | 23.7           | 34.7            | 3.7             | 5.2                       | 33                             |
| 2                             | 071100090103 | 3.7               | 29.1          | 23.7           | 34.7            | 3.7             | 5.2                       | 29                             |
| 3                             | 071100090103 | 3.7               | 29.1          | 23.7           | 34.7            | 3.7             | 5.2                       | 24                             |
| 4                             | 071100090103 | 3.7               | 29.1          | 23.7           | 34.7            | 3.7             | 5.2                       | 23                             |
| 4.1                           | 071100090103 | 3.7               | 29.1          | 23.7           | 34.7            | 3.7             | 5.2                       | 17.4                           |
| 4.9                           | 071100090103 | 3.7               | 29.1          | 23.7           | 34.7            | 3.7             | 5.2                       | 16.5                           |
| 6.1                           | 071100090103 | 3.7               | 29.1          | 23.7           | 34.7            | 3.7             | 5.2                       | 10.9                           |
| Central Plains/Cuivre/Salt    |              | 3.5               | 42.6          | 29.2           | 17.0            | 2.1             | 5.5                       | ----                           |

All stations of the study stream occur in the same 12-digit hydrologic unit. Comparison of land use between the Central Plains/Cuivre/Salt EDU and the 12-digit HUC containing the study segments showed the EDU contained a higher percentage of cropland and a lower percentage of forestland. The percentages of non-vegetated cover, grassland, herbaceous cover, and wetland/open water land uses were similar between the study area and the EDU. The differences in land use between the EDU and the HUC containing the study stream were minor. Figure 4 displays the land uses within the Dardenne Creek watershed.

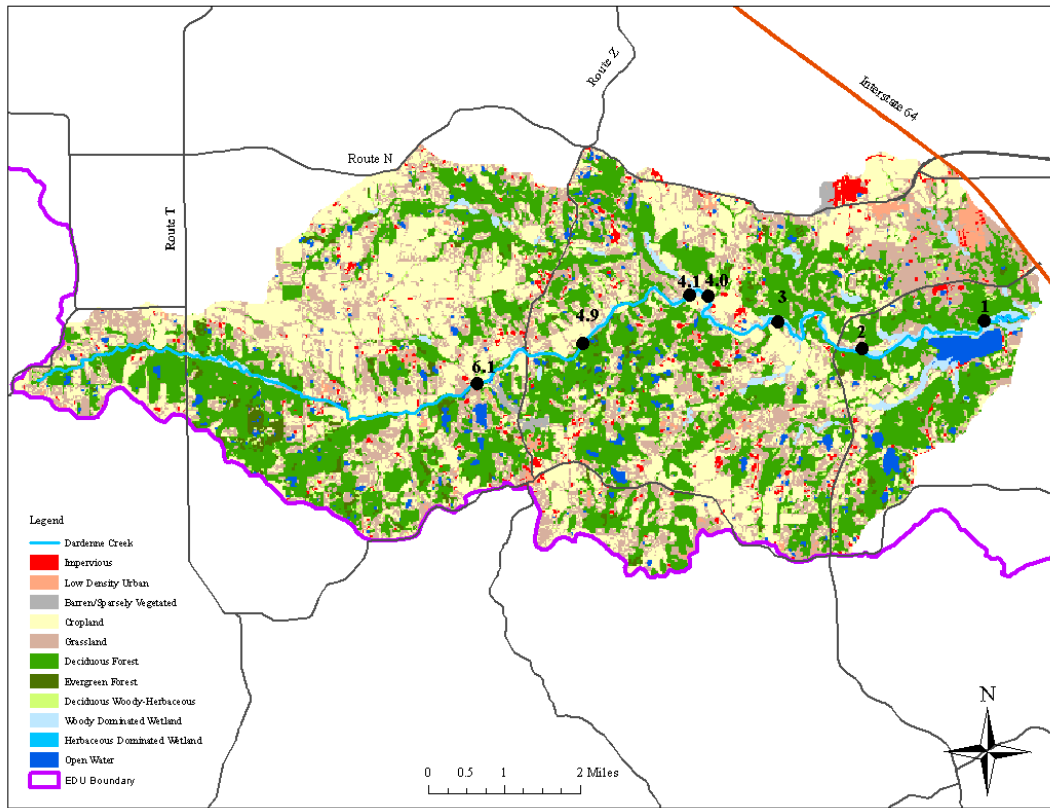


Figure 4. Land uses within the 12 digit HUC of Dardenne Creek

## 5.2 Stream Habitat Assessment

Habitat assessment scoring results are found in Table 2. If the study station SHAPP score is  $\geq 75\%$  of the control station score, the stations are considered to contain comparable habitats to the control station. Comparable habitats should support similar biological communities. All stations scored near 100 percent of the SHAPP control, South River. Based on SHAPP scores, it is presumed that Dardenne Creek has potential to support a biological community similar to the reference stream.

Table 2  
Stream Habitat Assessment Scores and Percentage Comparison

| Station                     | Score | % of Reference |
|-----------------------------|-------|----------------|
| Dardenne Creek 1            | 123   | >100%          |
| Dardenne Creek 2            | 116   | 98%            |
| Dardenne Creek 3            | 117   | 99%            |
| Dardenne Creek 4            | 113   | 96%            |
| Dardenne Creek 4.1          | 123   | >100%          |
| Dardenne Creek 4.9          | 122   | >100%          |
| Dardenne Creek 6.1          | 118   | 100%           |
| South River (SHAPP Control) | 118   | --             |

Habitat assessment of Dardenne Creek showed little variation among stations. The three upstream stations had slightly more epifaunal substrate available with more gravel and cobble sized material present and less sand in the channel than the downstream stations. The three downstream stations had a considerable amount of sand in the channel. All stations had a fair amount of sediment deposition along gravel bars and bends and at obstructions in the water. Slight embeddedness was observed among the gravel and substrate in the riffles. All stations had three-depth regimes present (slow-deep, slow-shallow, fast-shallow) but lacked any fast-deep flow regimes. Riffle quality was marginal at all stations. The stations generally had riffles that were fairly narrow and short. The channel at station 4.9 was mostly bedrock between riffles with pockets of gravel and smaller material interspersed. Stream banks were mostly stable throughout the study area, but they had very little vegetative cover. There was no channelization present at any of the stations and the riparian corridors were well established.

The habitat of South River, the SHAPP control, was similar to Dardenne Creek. South River had suboptimal epifaunal substrate and low embeddedness. Stable areas of cobble and large gravel were present in the stream, but there were also large areas of small-sized substrate present. There was a moderate amount of sediment deposition on the gravel bars and bends. Similar to the study stream, the fast-deep depth regime was lacking, but the other three types of velocity/depth regimes were present (slow-deep, slow-shallow, fast-shallow). Channel flow status appeared low, and riffle quality was marginal. Riffles were not as wide as the stream and were less than two times the stream width. No bedrock was present in the reach assessed, and the vegetative protection along the banks ranked low. The stream reach lacked any evidence of channelization and had good riparian areas with adequate bank stability.

### 5.3 Biological Assessment and Macroinvertebrate Community Analysis

Tables 3 and 4 provide scoring criteria and results for the fall and spring index periods, respectively. MSCI scores were calculated by scoring test station biological metrics using the appropriate BIOREF criteria. An MSCI score of 16-20 is considered fully supporting, 10-14 is partially supporting, and 4-8 is considered non-supporting.



There was little variability among the individual biological metrics for the fall season (Table 3). The two categories consistently deficient at each station were the number of EPT taxa present and the BI values. All stations had abundant taxa richness. BI and SDI values varied slightly throughout the reach. All stations scored 16 during the fall sampling period, which is the lowest value in the fully supporting biological category.

Table 3  
Metric Values and Scores for Dardenne Creek Stations, Fall 2014,  
Using Central Plains/Cuivre/Salt Biological Criteria

| Stations       | TR    | EPTT | BI      | SDI       | MSCI  | Support        |
|----------------|-------|------|---------|-----------|-------|----------------|
| 1a Value       | 81    | 15   | 6.5     | 3.55      |       | <b>Full</b>    |
| 1a Score       | 5     | 3    | 3       | 5         | 16    |                |
| 1b Value       | 80    | 15   | 6.4     | 3.49      |       | <b>Full</b>    |
| 1b Score       | 5     | 3    | 3       | 5         | 16    |                |
| 2 Value        | 79    | 13   | 6.7     | 3.47      |       | <b>Full</b>    |
| 2 Score        | 5     | 3    | 3       | 5         | 16    |                |
| 3 Value        | 74    | 13   | 6.5     | 3.41      |       | <b>Full</b>    |
| 3 Score        | 5     | 3    | 3       | 5         | 16    |                |
| 4 Value        | 77    | 10   | 6.8     | 3.5       |       | <b>Full</b>    |
| 4 Score        | 5     | 3    | 3       | 5         | 16    |                |
| 4.1 Value      | 74    | 13   | 6.4     | 3.34      |       | <b>Full</b>    |
| 4.1 Score      | 5     | 3    | 3       | 5         | 16    |                |
| 4.9 Value      | 78    | 13   | 6.7     | 3.29      |       | <b>Full</b>    |
| 4.9 Score      | 5     | 3    | 3       | 5         | 16    |                |
| 6.1 Value      | 80    | 11   | 6.9     | 3.23      |       | <b>Full</b>    |
| 6.1 Score      | 5     | 3    | 3       | 5         | 16    |                |
| BIOREF Score=5 | >73   | >17  | <6.4    | >2.99     | 20-16 | <b>Full</b>    |
| BIOREF Score=3 | 73-37 | 17-9 | 6.4-8.2 | 2.99-1.49 | 14-10 | <b>Partial</b> |
| BIOREF Score=1 | <37   | <9   | >8.2    | <1.49     | 8-4   | <b>Non</b>     |

MSCI Scoring Table (in light gray) developed from BIORREF streams ( $n = 11$ ). TR=Taxa Richness; EPTT=Ephemeroptera, Plecoptera, Trichoptera Taxa; BI=Biotic Index; SDI=Shannon Diversity Index

All Dardenne Creek stations scored in the partially supporting category in spring 2015. Biological metrics overall were lower during the spring compared to the fall season, with scores ranging from 10 – 14 (Table 4). All four biological metrics scored suboptimal at all stations with the exception of taxa richness at station 4.1, which was the only station to score a 5 for any of the metrics. Station 1 had only eight EPT taxa present, resulting in the lowest possible score for that metric. By comparison, all other stations had at least 10 taxa, which was sufficient to score mid-range for that metric. Similar to the fall biological metrics, the BI and SDI showed only slight differences among stations.

Table 4  
Metric Values and Scores for Dardenne Creek Stations, Spring 2015,  
Using Central Plains/Cuivre/Salt Biological Criteria

| Stations       | TR    | EPTT | BI      | SDI       | MSCI  | Support        |
|----------------|-------|------|---------|-----------|-------|----------------|
| 1 Value        | 69    | 8    | 7.0     | 2.96      |       | <b>Partial</b> |
| 1 Score        | 3     | 1    | 3       | 3         | 10    |                |
| 2 Values       | 72    | 13   | 7.0     | 3.03      |       | <b>Partial</b> |
| 2 Score        | 3     | 3    | 3       | 3         | 12    |                |
| 3 Value        | 66    | 10   | 6.8     | 3.13      |       | <b>Partial</b> |
| 3 Score        | 3     | 3    | 3       | 3         | 12    |                |
| 4 Value        | 71    | 16   | 7.3     | 2.7       |       | <b>Partial</b> |
| 4 Score        | 3     | 3    | 3       | 3         | 12    |                |
| 4.1 Value      | 82    | 17   | 7.1     | 2.82      |       | <b>Partial</b> |
| 4.1 Score      | 5     | 3    | 3       | 3         | 14    |                |
| 4.9 Value      | 77    | 15   | 7.0     | 2.94      |       | <b>Partial</b> |
| 4.9 Score      | 3     | 3    | 3       | 3         | 12    |                |
| 6.1 Value      | 75    | 14   | 7.1     | 3.05      |       | <b>Partial</b> |
| 6.1 Score      | 3     | 3    | 3       | 3         | 12    |                |
| BIOREF Score=5 | >77   | >17  | <6.3    | >3.21     | 20-16 | <b>Full</b>    |
| BIOREF Score=3 | 77-39 | 17-9 | 6.3-8.1 | 3.21-1.61 | 14-10 | <b>Partial</b> |
| BIOREF Score=1 | <39   | <9   | >8.1    | <1.61     | 8-4   | <b>Non</b>     |

MSCI Scoring Table (in light gray) developed from BIORREF streams ( $n = 7$ ). TR=Taxa Richness; EPTT=Ephemeroptera, Plecoptera, Trichoptera Taxa; BI=Biotic Index; SDI=Shannon Diversity Index

### 5.3.1 Dardenne Creek Macroinvertebrate Community Composition

EPT taxa, percent EPT, and percent Diptera taxa for Dardenne Creek are presented in Table 5 for fall 2014 and Table 6 for spring 2015. These tables also provide percent composition data for the top five dominant macroinvertebrate families at each Dardenne Creek station. The percent relative abundance data of the variables were averaged from the sum of the three macroinvertebrate habitats (coarse substrate, nonflow, and rootmat) sampled at each station. For comparison, the tables also display the corresponding values of the BIORREF data for the Central Plains/Cuivre/Salt EDU.

#### Fall 2014

The fall 2014 macroinvertebrate community analysis is shown in Table 5. The total percentage of EPT taxa ranged from 23.5 percent to 45.3 percent. The average EPT taxa value was 33.5 percent, which was comparable to the BIORREF value of 36.8 percent. Of the three EPT insect orders, Ephemeroptera composed the majority of the biological community at all seven stations, a trend similar to the BIORREF data. Plecoptera taxa composed up to 4 percent of the biological community at station 6.1 and was absent from three of the stations. Trichoptera taxa were present at all stations with station 4.1 having

the highest abundance. Diptera taxa ranged from 43 percent to 60.3 percent with an average of 51.2 percent, which was higher than the BIOREF average of 33.6 percent.

Table 5  
Fall 2014 Macroinvertebrate Community Analysis

| Stations                              | 1a   | 1b   | 2    | 3    | 4    | 4.1  | 4.9  | 6.1  | BIOREF<br>Average |
|---------------------------------------|------|------|------|------|------|------|------|------|-------------------|
| Variables                             |      |      |      |      |      |      |      |      |                   |
| % Ephemeroptera                       | 17.6 | 21.9 | 14.0 | 12.4 | 20.4 | 26.9 | 34.9 | 21.7 | 22.3              |
| % Plecoptera                          | 0.0  | 0.0  | <0.1 | 0.0  | 0.0  | <0.1 | <0.1 | 4.0  | <0.1              |
| % Trichoptera                         | 11.9 | 11.7 | 15.4 | 11.1 | 9.8  | 16.8 | 10.4 | 7.5  | 14.5              |
| % Total EPT                           | 29.5 | 33.6 | 29.4 | 23.5 | 30.2 | 43.7 | 45.3 | 33.2 | 36.8              |
| % Diptera                             | 53.2 | 46.3 | 46.9 | 60.3 | 54.3 | 45.0 | 43.0 | 60.3 | 33.6              |
| % Dominant Macroinvertebrate Families |      |      |      |      |      |      |      |      |                   |
| Chironomidae                          | 49.8 | 43.2 | 42.0 | 54.4 | 50.3 | 39.1 | 41.3 | 59.5 | 31.5              |
| Hydropsychidae                        | 9.7  | 10.1 | 13.9 | 10.0 | 8.2  | 13.2 | 8.2  | 6.1  | 8.0               |
| Baetidae                              | 9.4  | 12.7 | 6.6  | 5.0  | 5.9  | 9.9  | 4.9  | 3.5  | 2.5               |
| Elmidae                               | 5.3  | 5.1  | 5.2  | 9.4  | 3.2  | 3.8  | 4.4  | 3.5  | 11.5              |
| Coenagrionidae                        | 4.4  | 4.0  | 6.7  | 1.9  | 4.5  | 1.2  | 1.2  | 2.1  | 3.0               |
| Caenidae                              | 3.6  | 3.8  | 5.5  | 5.1  | 10.2 | 11.3 | 22.1 | 14.6 | 3.5               |
| Acarina                               | 3.1  | 4.1  | 3.0  | 0.4  | 1.1  | 1.3  | 1.3  | 0.4  | 0.7               |
| Heptageniidae                         | 3.1  | 3.7  | 1.8  | 2.2  | 4.3  | 5.7  | 7.9  | 0.4  | 2.5               |

The faded text indicates taxa not in the top five dominant taxa for the listed station.

Chironomidae was the most abundant family at all stations during the fall, making up approximately 50 percent or greater of the macroinvertebrate community at half of the stations. The BIOREF streams had an average of 31.5 percent Chironomidae. Hydropsychidae and Baetidae also were common among all stations. Elmidae and Coenagrionidae were more prevalent in the downstream stations, whereas two mayfly families, Caenidae and Heptageniidae, were more prevalent in the upstream stations. The previous bioassessment reported that Dardenne Creek contained the same dominant taxa in fall 2008; however, the average percentage of Chironomidae was lower (2008 average 27.8 percent), but Caenidae (2008 average 20.4 percent) and Baetidae (2008 average 12.9 percent) were higher. The percentage of Hydropsychidae in the previous study was comparable at an average of 11.4 percent.

*Tanytarsus* sp., *Cheumatopsyche* sp., and *Polypedilum flavum* were dominant taxa occurring at all stations during the fall. *Stenelmis* sp. also was common but in less abundance than the aforementioned three taxa. These four taxa also rank as dominant taxa among BIOREF stations. *Tricorythodes* sp. was ranked as the dominant taxon in the BIOREF data for the Central Plains/Cuivre/Salt EDU. *Tricorythodes* sp. was present at stations 1, 2, and 3 but was absent from the upstream stations. *Caenis latipennis* was a common Ephemeroptera species at all stations except station 1.

Figure 5 provides a comparison of taxa tolerance for the fall sampling season. This comparison indicates that a large proportion of taxa are within the mid-range biotic index category, similar to the EDU data. However, the Dardenne Creek stations essentially lack sensitive taxa (BI < 2.5), which were at least present in BIOREF samples.

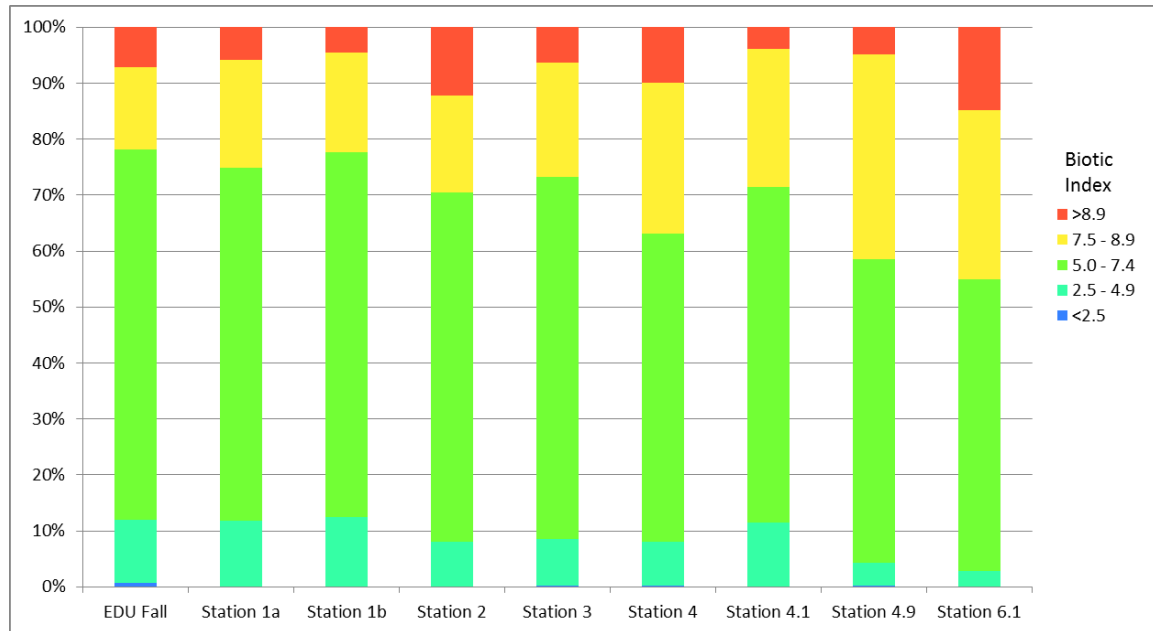


Figure 5. Fall 2014 Percent of Taxa by Tolerance Range

### Spring 2015

The spring 2015 macroinvertebrate community analysis is shown in Table 6. The total percentage of EPT taxa ranged from 5.9 percent to 9.8 percent. The average EPT taxa value was 7.2 percent, less than a third of the BIOREF value of 26 percent. As in the fall, Ephemeroptera composed the majority of the EPT taxa, a trend also apparent in the BIOREF data. Plecoptera taxa were most abundant at stations 3 and 6.1 where they made up 1.2 percent of the community. Unlike the fall data, Plecoptera were present at all of the stations, even though they were recorded at very low abundances. Trichoptera taxa were present at all stations as well, also in low abundances. The low Plecoptera and Trichoptera abundances are a tendency displayed in the BIOREF data as well (Table 6). Dipteran taxa ranged from 84.3 percent to 91.9 percent with an average of 88.3 percent, which was higher than the BIOREF average of 53.7 percent.

Table 6  
Spring 2015 Macroinvertebrate Community Analysis

| Stations                              | 1    | 2    | 3    | 4    | 4.1  | 4.9  | 6.1  | BIOREF Average |
|---------------------------------------|------|------|------|------|------|------|------|----------------|
| Variables                             |      |      |      |      |      |      |      |                |
| % Ephemeroptera                       | 6.7  | 5.0  | 6.6  | 4.2  | 3.8  | 5.1  | 5.3  | 20.7           |
| % Plecoptera                          | 0.6  | 0.5  | 1.2  | 1.1  | 0.1  | 0.8  | 1.2  | 2.4            |
| % Trichoptera                         | 0.3  | 1.0  | 2.0  | 0.6  | 1.4  | 0.7  | 1.4  | 3.0            |
| % Total EPT                           | 7.6  | 6.5  | 9.8  | 5.9  | 6.1  | 6.6  | 7.9  | 26.0           |
| % Diptera                             | 86.3 | 86.7 | 87.3 | 91.9 | 91.1 | 90.3 | 84.3 | 53.7           |
| % Dominant Macroinvertebrate Families |      |      |      |      |      |      |      |                |
| Chironomidae                          | 83.8 | 83.8 | 83.3 | 90.3 | 88.2 | 88.7 | 82.7 | 48.4           |
| Baetidae                              | 3.2  | 3.0  | 4.6  | 2.3  | 1.1  | 1.1  | 0.5  | 4.3            |
| Tubificidae                           | 2.5  | 2.3  | 0.6  | 1.2  | 0.4  | 0.6  | 2.2  | 2.5            |
| Ceratopogonidae                       | 0.4  | 1.6  | 1.0  | 0.4  | 0.8  | 0.7  | 0.8  | 0.9            |
| Caenidae                              | 2.2  | 1.3  | 1.2  | 0.8  | 1.4  | 3.3  | 4.3  | 9.3            |
| Simuliidae                            | 2.1  | 1.0  | 2.4  | 1.0  | 1.2  | 0.2  | 0.2  | 3.0            |
| Heptageniidae                         | 1.2  | 0.7  | 0.8  | 1.1  | 1.2  | 0.7  | 0.5  | 3.2            |
| Hydropsychidae                        | 0.2  | 0.7  | 1.9  | 0.2  | 0.9  | 0.6  | 1.2  | 0.8            |

The faded text indicates taxa not in the top five dominant for the listed station.

Chironomidae and Baetidae were consistently present among the top five dominant taxa in Dardenne Creek spring samples. Chironomidae was the most abundant family at all stations, making up the majority (average of 85.8 percent) of taxa present at the stations, compared to an average of 48.4 percent of the taxa at the BIORREF stations. Caenidae was also common in Dardenne Creek. Similar to the fall data, Heptageniidae was more prevalent in the upstream stations. Review of the spring 2009 bioassessment showed that in addition to Chironomidae, Baetidae, and Caenidae being dominant taxa, Perlidae was also dominant at all stations. Chironomidae were more abundant in 2015 than in spring 2009 (2009 average 68.7 percent). Baetidae (2009 average 10.9 percent), Caenidae (2009 average 5.5 percent), and Heptageniidae (2009 average 2.2 percent) were more abundant during the spring 2009 bioassessment than during the spring 2015 bioassessment.

*Hydrobaenus* sp., *Cricotopus/Orthocladius*, *Tanytarsus* sp., and *Polypedilum flavum* (all Chironomidae) were dominant taxa in Dardenne Creek during the spring. Of those four, *Hydrobaenus* sp. is the only taxon not ranked within the 10 dominant taxa among BIORREF samples, but it was either the dominant or the second most abundant taxa at all of the study stream stations. The riffle beetle *Stenelmis* sp. and two mayfly taxa, *Caenis latipennis* and *Acerpenna* sp., also were dominant taxa in the BIORREF streams. These taxa were common in Dardenne Creek as well but not as abundant as the BIORREF streams.

Figure 6 shows a comparison of taxa tolerance for the spring 2015 sampling period. Compared to BIORREF samples, Dardenne Creek stations had at least twice as many tolerant taxa and a large portion of taxa in the mid-range biotic index category. During

spring sampling, the percentage of macroinvertebrates in the highly tolerant category ranged from 15.6 percent to 34.7 percent. Highly tolerant taxa made up 5.8 percent of the BIOREF streams. In contrast to the fall sampling period, sensitive taxa were present in Dardenne Creek during the spring sampling period but in lower abundance than the BIOREF streams.

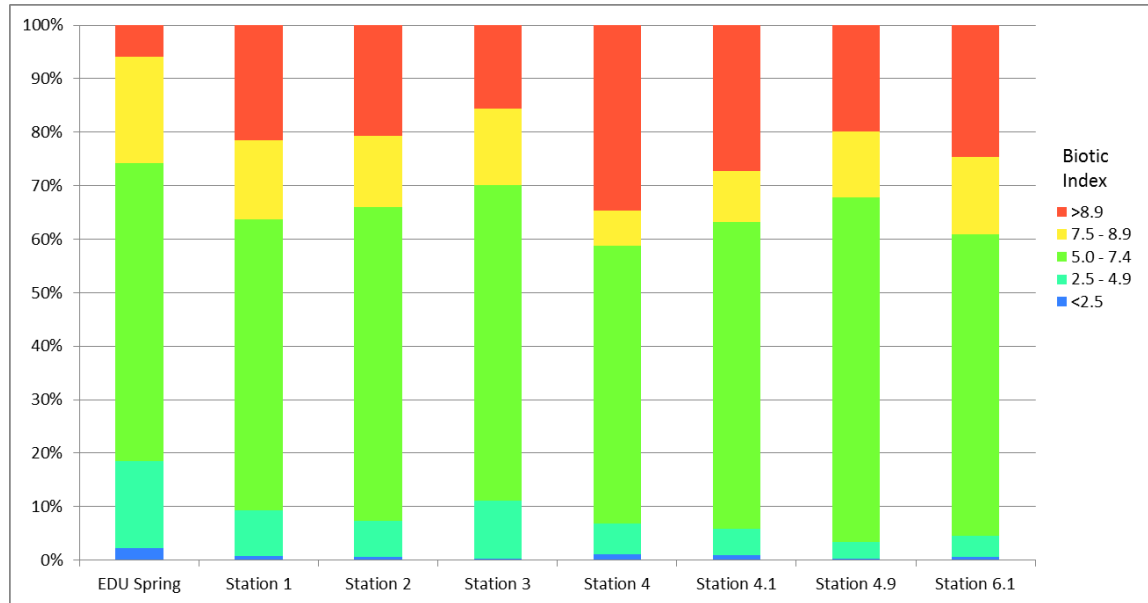


Figure 6. Spring 2015 Percent of Taxa by Tolerance Range

### 5.3.2 Biological Assessment QSIT

During the fall sampling season, duplicate samples were collected at station 1. These samples were analyzed for QSIT to compare the two samples to determine whether they met the 70 percent threshold for duplicate samples (Rabeni et al. 1999, MDNR 2012a). The QSIT for these two samples was 82.8%.

## 5.4 Data Trends

Over the course of studying Dardenne Creek, 46 samples have been collected. From 2002 to the current study, only 16 of 46 (34.8%) samples have attained fully supporting MSCI scores (Table 7). Dardenne Creek has consistently scored poorly in the EPT taxa and BI biological metric categories. Of 46 total samples, the EPT taxa metric has scored in the optimal category only four times. These samples included three of the mid-reach stations (stations 3, 4, and 4.1) in spring 2009 and one station (station 2) in fall 2002. The BI has scored optimally only seven times out of the 46 total samples. All seven instances of optimal BI scoring occurred during the spring of 2009. There have been 17 optimal taxa richness values and 16 of 46 SDI values scored optimally.

Table 7  
Overview of Historical MSCI scores of Dardenne Creek

| Stations | Spring 2002 | Fall 2002 | Fall 2005 | Spring 2006 | Fall 2008 | Spring 2009 | Fall 2014 | Spring 2015 |
|----------|-------------|-----------|-----------|-------------|-----------|-------------|-----------|-------------|
| 1        | 14          | 16        |           |             | 12        | 14          | 16        | 10          |
| 2        | 14          | 18        |           |             | 12        | 16          | 16        | 12          |
| 3        | 8           | 16        | 14*       | 14          | 14        | 16          | 16        | 12          |
| 4        | 8           | 10*       | 10*       | 12          | 12        | 16          | 16        | 12          |
| 4.1      |             |           | 10*       | 12          | 12        | 20          | 16        | 14          |
| 4.9/5    | 12          | 12*       |           |             | 12        | 14          | 16        | 12          |
| 6/6.1    | 8           | 12*       |           |             | 16        | 16          | 16        | 12          |

Shaded cells indicate attainment of fully supporting status

\*Indicates samples in which only 2 of the 3 habitats were fully represented

## 5.5 Physicochemical Water Parameters

### 5.5.1 Sonde Deployment: Dissolved Oxygen, Temperature, and Specific Conductivity

Data loggers were deployed at two of the seven stations on Dardenne Creek (stations 1 and 3) for six days in August 2014 prior to fall sampling. Data loggers collected DO (mg/L), temperature (°C), and specific conductivity (µS/cm) measurements every 15 minutes and were deployed during the morning of August 8 and retrieved during the afternoon of August 14. The DO minimums and maximums exhibited patterns that trended with time of day. The peak of DO levels occurred in the evening before sunset, and the minimum DO levels occurred in the early morning after sunrise.

Figure 7 illustrates the DO data for Station 1. At Station 1 DO results ranged from 6.34 to 8.69 mg/L, and temperature ranged from 21.97 to 26.23 °C. During the deployment period, DO at station 1 remained well above the 5.0 mg/L minimum established by WQS (MDNR 2014f).

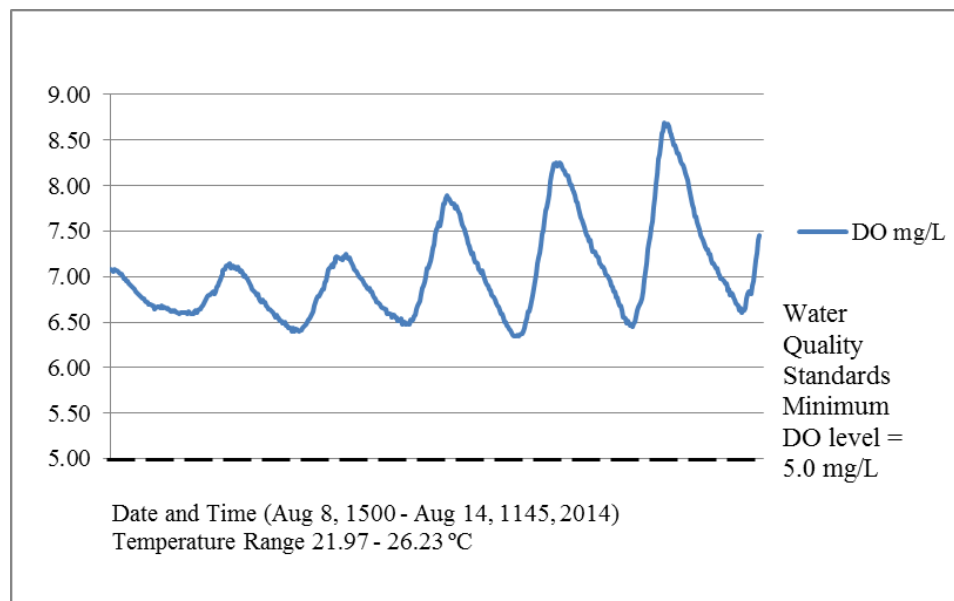


Figure 7. Dissolved Oxygen, Dardenne Creek Station 1.

Figure 8 illustrates the DO data for Station 3. DO ranged from 4.58 to 8.60 mg/L, and temperature ranged from 21.97 to 27.76 °C. DO values fell below the 5.0 mg/L minimum allowable by the WQS (MDNR 2014f) during the latter part of the six-day deployment period at station 3. Of the 560 measurements collected, 10 percent were less than 5 mg/L.

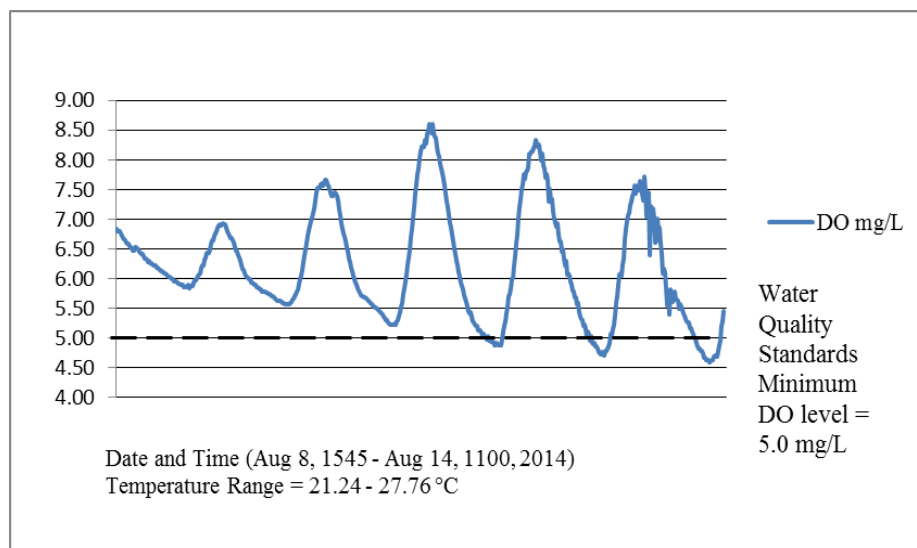


Figure 8. Dissolved Oxygen, Dardenne Creek Station 3.

On August 7, the day prior to the deployment period, the study area received approximately 0.75 inches of rain. Figures 6 and 7 both display reduced variation in the peaks and valleys of DO concentrations during the first few days of deployment, which contrasts with the latter part of the deployment period as the river stabilized from the



influx of the rain event. Refer to Appendix B for the DO, temperature, and specific conductivity values.

### 5.5.2 Water Quality Measurements

The physicochemical results measured *in situ* showed little variation during the fall (Table 8). The DO levels ranged from 7.4 mg/L to 8.4 mg/L. All stations remained above the WQS 5.0 mg/L minimum during the fall sampling. Conductivity was elevated at station 6.1 compared to the remaining downstream stations. Turbidity values ranged from 1.53 NTU to 4.48 NTU.

Table 8  
Fall 2014 Flow and *In Situ* Water Quality Measurements

| Stations | Sample Time & Date | Flow (cfs) | Temperature (°C) | Dissolved O <sub>2</sub> (mg/L) | Conductivity (µS/cm) | pH  | Turbidity (NTU) |
|----------|--------------------|------------|------------------|---------------------------------|----------------------|-----|-----------------|
| 1a       | 0840 9/25          | 3.8        | 17.0             | 8.4                             | 457                  | 8   | 4.48            |
| 1b       | 0840 9/25          | 3.8        | 17.0             | 8.3                             | 456                  | 7.9 | 4.04            |
| 2        | 0940 9/29          | 1.6        | 18.0             | 7.4                             | 457                  | 7.9 | 3.17            |
| 3        | 1115 9/29          | 1.0        | 19.0             | 7.8                             | 430                  | 7.8 | 5.85            |
| 4        | 0955 9/30          | 0.3        | 18.0             | 7.7                             | 418                  | 7.7 | 1.80            |
| 4.1      | 0840 9/30          | 0.7        | 17.0             | 7.9                             | 420                  | 7.9 | 1.55            |
| 4.9      | 1200 9/30          | 0.4        | 18.0             | 8.0                             | 457                  | 8   | 2.11            |
| 6.1      | 1420 9/29          | 0.3        | 19.0             | 8.1                             | 593                  | 8.1 | 1.53            |

Table 9 displays the data measured *in situ* from the spring sampling season. DO levels ranged from 10.5 mg/L to 12.7 mg/L. All stations remained above the WQS 5.0 mg/L minimum during spring sampling. Turbidity values ranged from 2.48 NTU to 8.78 NTU. The spring sampling event was interrupted by approximately 0.7 inches of rain, causing stations 1, 4, and 4.1 to be sampled approximately one week later than the remaining stations. Elevated flow from this rain is likely the cause of the elevated turbidity and the lower conductivity values for stations 1, 4, and 4.1.

Table 9  
Spring 2015 Flow and *In Situ* Water Quality Measurements

| Stations | Sample Time & Date | Flow (cfs) | Temperature (°C) | Dissolved O <sub>2</sub> (mg/L) | Conductivity (µS/cm) | pH  | Turbidity (NTU) |
|----------|--------------------|------------|------------------|---------------------------------|----------------------|-----|-----------------|
| 1        | 1300 3/30          | 32.0       | 10.0             | 11.2                            | 377                  | 8.2 | 8.78            |
| 2        | 1035 3/24          | 12.5       | 8.0              | 10.5                            | 428                  | 8.3 | 3.39            |
| 3        | 1600 3/24          | 10.9       | 9.0              | 11.4                            | 416                  | 8.1 | 4.19            |
| 4        | 1040 3/30          | 15.3       | 7.0              | 11.1                            | 359                  | 8.0 | 7.59            |
| 4.1      | 1100 3/30          | 12.0       | 8.0              | 11.4                            | 250                  | 8.1 | 7.09            |
| 4.9      | 1315 3/24          | 5.6        | 8.0              | 12.7                            | 428                  | 8.5 | 3.83            |
| 6.1      | 1440 3/24          | 6.4        | 8.0              | 12.4                            | 425                  | 8.3 | 2.48            |

Although there are currently no nutrient criteria in place for Missouri streams and rivers, the values for each season were compared to the United States Environmental Protection Agency's (USEPA) December 2000 Ambient Water Quality Criteria Recommendations for Rivers and Streams in Nutrient Ecoregion IX (USEPA 2000). USEPA's recommended values for the Level III Interior River Lowland are 0.22 mg/L nitrate + nitrite-N, 1.7 mg/L total nitrogen, 0.08 mg/L total phosphorus, and 15 NTU turbidity. The nitrate + nitrite-N value exceeded EPA's recommended value at stations 1a and 1b in fall 2014 (Table 10). Total nitrogen, total phosphorus, and turbidity were below the recommended values. The sulfate concentration was elevated at station 6.1 compared to the downstream stations.

Table 10  
Fall 2014 Water Chemistry Concentrations

| Stations | Sample Time & Date | Parameter mg/L     |                                     |                   |                   |          |         |
|----------|--------------------|--------------------|-------------------------------------|-------------------|-------------------|----------|---------|
|          |                    | NH <sub>3</sub> -N | NO <sub>2</sub> +NO <sub>3</sub> -N | T-N               | T-P               | Chloride | Sulfate |
| 1a       | 0840 9/25          | 0.04 <sup>†</sup>  | 0.54                                | 0.88              | 0.06              | 23.2     | 20.6    |
| 1b       | 0840 9/25          | 0.03 <sup>†</sup>  | 0.54                                | 0.90              | 0.06              | 23.4     | 20.6    |
| 2        | 0940 9/29          | 0.04 <sup>†</sup>  | 0.04                                | 0.24              | <0.01*            | 21.4     | 14.1    |
| 3        | 1115 9/29          | <0.03*             | 0.01                                | 0.19 <sup>†</sup> | 0.03 <sup>†</sup> | 20.8     | 14.0    |
| 4        | 0955 9/30          | <0.03*             | 0.03                                | 0.26              | 0.03 <sup>†</sup> | 20.1     | 14.5    |
| 4.1      | 0840 9/30          | <0.03*             | 0.03                                | 0.17 <sup>†</sup> | 0.03 <sup>†</sup> | 20.3     | 15.3    |
| 4.9      | 1200 9/30          | <0.03*             | 0.04                                | 0.20              | 0.02 <sup>†</sup> | 24.9     | 22.4    |
| 6.1      | 1420 9/29          | <0.03*             | 0.07                                | 0.26              | 0.02 <sup>†</sup> | 23.2     | 57.8    |

\* Below detectable limits.

<sup>†</sup> Estimated Value, detected below practical quantitation limits.

Nitrate + nitrite-N exceeded the USEPA recommended value in spring 2015 (Table 11) at stations 1, 4, and 4.1. Total nitrogen, total phosphorus, and turbidity were below the recommended values. Sulfate values were higher at the two most upstream stations than the remaining stations.

Table 11  
Spring 2015 Water Chemistry Concentrations

| Stations | Sample Time & Date | Parameter mg/L     |                                     |      |                   |          |         |
|----------|--------------------|--------------------|-------------------------------------|------|-------------------|----------|---------|
|          |                    | NH <sub>3</sub> -N | NO <sub>2</sub> +NO <sub>3</sub> -N | T-N  | T-P               | Chloride | Sulfate |
| 1        | 1300 3/30          | 0.05               | 0.36                                | 0.62 | 0.04 <sup>†</sup> | 22.6     | 25.1    |
| 2        | 1035 3/24          | 0.04 <sup>†</sup>  | 0.08                                | 0.43 | <0.01*            | 26.5     | 34.5    |
| 3        | 1600 3/24          | 0.04 <sup>†</sup>  | 0.06                                | 0.33 | <0.01*            | 26.7     | 37.2    |
| 4        | 1040 3/30          | 0.04 <sup>†</sup>  | 0.26                                | 0.6  | 0.03 <sup>†</sup> | 20.5     | 32.4    |
| 4.1      | 1100 3/30          | 0.03               | 0.28                                | 0.53 | 0.03 <sup>†</sup> | 19.4     | 30.9    |
| 4.9      | 1315 3/24          | 0.03               | 0.02                                | 0.27 | <0.01*            | 27.6     | 50.1    |
| 6.1      | 1440 3/24          | <0.03*             | 0.08                                | 0.35 | <0.01*            | 27.0     | 53.1    |

\* Below detectable limits

<sup>†</sup> Estimated Value, detected below practical quantitation limits.

## 5.6 Benthic Fine Sediment Coverage Estimation

Percentage of benthic fine sediment coverage was estimated at each of the seven Dardenne Creek test stations and at eight control stations located at Big Creek, Hays Creek, North Fork Cuivre River, Sugar Creek, and South River, a BIOREF stream. The benthic sediment estimates are presented in Table 12. The Dardenne Creek test stations were compared individually with the pooled sediment control stations.

Among Dardenne Creek stations, the mean benthic fine sediment coverage ranged from 28.5 to 78.7 percent. Six of the Dardenne Creek stations had higher estimates of benthic fine sediment than the control stations. The exception, Dardenne Creek Station 6.1, had a mean of 28.5 percent. The upper stations of Dardenne Creek generally contained less sediment than the downstream stations. Among the eight control stations, the four South River stations had estimates that were slightly higher than Big Creek, Hays Creek, North Fork Cuivre River, and Sugar Creek. The mean of benthic fine sediment estimates of the control streams ranged from 13.9 to 49.2 percent. Four of the seven Dardenne Creek stations (stations 1, 3, 4, and 4.1) were statistically significantly different from the control streams ( $p < 0.05$ ).

Table 12  
Percentage of Benthic Sediment Observed per Grid and Quadrat Using Visual Estimation  
Method at Dardenne Creek and Control Stream Sample Stations, Fall 2016

| Grid No.-<br>Quadrat No. | Dardenne Creek |      |        |        |        |      |      | Big Ck.                  | Hays Ck. | NFCR | Sugar Ck. | South River |      |       |      |
|--------------------------|----------------|------|--------|--------|--------|------|------|--------------------------|----------|------|-----------|-------------|------|-------|------|
|                          | 1              | 2    | 3      | 4      | 4.1    | 4.9  | 6.1  |                          |          |      |           | 1           | 1    | 1     | 1    |
| 1-1                      | 90             | 75   | 95     | 99     | 100    | 80   | 7.5  | 10                       | 6.5      | 77.5 | 5         | 60          | 95   | 10    | 25   |
| 1-2                      | 35             | 37.5 | 75     | 98     | 1.5    | 60   | 5    | 5                        | 2        | 60   | 15        | 45          | 87.5 | 5     | 32.5 |
| 1-3                      | 60             | 25   | 100    | 99     | 25     | 100  | 4    | 5                        | 42.5     | 90   | 30        | 17.5        | 55   | 3     | 75   |
| 1-4                      | 47.5           | 60   | 100    | 100    | 3      | 32.5 | 2    | 5                        | 85       | 77.5 | 2         | 15          | 96.5 | 22.5  | 7.5  |
| 1-5                      | 30             | 37.5 | 37.5   | 95     | 70     | 62.5 | 1    | 7.5                      | 0        | 85   | 57.2      | 47.5        | 75   | 35    | 35   |
| 1-6                      | 55             | 98   | 62.5   | 72.5   | 52.5   | 100  | 60   | 5                        | 9        | 35   | 10        | 100         | 99   | 1.5   | 35   |
| 2-1                      | 92.5           | 85   | 98     | 77.5   | 62.5   | 90   | 65   | 100                      | 95       | 15   | 17.5      | 60          | 42.5 | 65    | 60   |
| 2-2                      | 98             | 15   | 100    | 32.5   | 67.5   | 87.5 | 12.5 | 0                        | 2        | 15   | 10        | 60          | 65   | 2     | 10   |
| 2-3                      | 62.5           | 30   | 70     | 95     | 100    | 5    | 40   | 100                      | 15       | 25   | 12.5      | 87.5        | 17.5 | 35    | 5    |
| 2-4                      | 82.5           | 72.5 | 100    | 65     | 95     | 27.5 | 55   | 100                      | 3        | 45   | 15        | 100         | 10   | 5     | 100  |
| 2-5                      | 100            | 52.5 | 42.5   | 10     | 40     | 15   | 100  | 100                      | 4        | 60   | 10        | 15          | 5    | 60    | 100  |
| 2-6                      | 95             | 20   | 100    | 65     | 25     | 27.5 | 100  | 4                        | 25       | 10   | 22.5      | 42.5        | 12.5 | 12.5  | 92.5 |
| 3-1                      | 90             | 65   | 42.5   | 100    | 82.5   | 37.5 | 5    | 7.5                      | 1.5      | 12.5 | 10        | 62.5        | 57.5 | 35    | 80   |
| 3-2                      | 85             | 72.5 | 67.5   | 90     | 40     | 85   | 8    | 10                       | 32.5     | 4    | 4         | 5           | 10   | 67.5  | 2.5  |
| 3-3                      | 87.5           | 22.5 | 55     | 97.5   | 50     | 99   | 20   | 75                       | 20       | 2    | 4         | 80          | 5    | 100   | 72.5 |
| 3-4                      | 80             | 90   | 70     | 100    | 70     | 1.5  | 12.5 | 20                       | 5        | 4    | 17.5      | 3           | 15   | 85    | 4    |
| 3-5                      | 90             | 25   | 27.5   | 100    | 92.5   | 90   | 12.5 | 20                       | 5        | 9    | 5         | 70          | 12.5 | 80    | 1.5  |
| 3-6                      | 95             | 77.5 | 57.5   | 20     | 90     | 10   | 2.5  | 10                       | 9        | 37.5 | 2         | 15          | 5    | 65    | 1    |
| Mean                     | 76.4           | 53.4 | 69.4   | 78.7   | 59.3   | 56.1 | 28.5 | 32.4                     | 20.3     | 36.9 | 13.9      | 49.2        | 42.5 | 38.28 | 41.0 |
| KW<br>Anova              | p<0.05         | NS   | p<0.05 | p<0.05 | p<0.05 | NS   | NS   | Mean of controls = 34.31 |          |      |           |             |      |       |      |

## **6.0 Discussion**

### **6.1 Land Use and Habitat**

Station 1 was located within the August A. Busch Conservation Area, an area that is mostly forested. Just outside the conservation area, the landscape transitions to subdivisions (many with manicured lawns) interspersed with farmland and pockets of forestland. There were several areas throughout the study area under construction, with new subdivisions and houses being built, as well as commercial property development. The watershed upstream of the sampling reach appears to be mostly farmland and forestland with fewer subdivisions.

Instream woody debris was present throughout the stream reach. The upper reach of the study area contains substrate more suitable for epifaunal habitat (less sand and more gravel-sized material suitable for macroinvertebrate colonization). Riffles were of marginal quality throughout the stream, which was most noticeable at the lower half of the study reach. Riffle complexes were farther apart in the lower reach of the stream, and deeper, longer pools and depositional substrates were more dominant. Although vegetative protection of the banks ranked low at each station, all of the stations had well-developed riparian corridors and had no evidence of channelization. During the study period, there was little trash (tires, appliances, etc.) found in the creek. A few of the stations in the mid-reach had levees built along the stream margins to decrease flooding into adjacent cropland. The habitat assessment indicated the study reach is similar to the reference stream and should support a similar macroinvertebrate community; however, the stream has not achieved fully supporting status regularly.

### **6.2 Macroinvertebrate Bioassessment**

Macroinvertebrate abundance was high during both seasons. During the fall, only four of the 24 habitats collected required greater than 20 percent of the material to be subsampled in order to reach the target number of macroinvertebrates; three of these four were coarse substrate samples. During the spring, only one habitat (a non-flow) of the 21 habitats collected required greater than 20 percent of the material to be subsampled.

The multi-metric MSCI scores of Dardenne Creek showed consistency longitudinally per season; however, the scores differed per season. During the fall season, all stations achieved fully supporting rankings with scores of 16. The percent of EPT taxa was similar between the study stream and the BIOREF data during the fall, but Diptera were more abundant than the BIOREF data, particularly Chironomidae. During the spring, all seven stations scored in the partially supporting category (range of scores 10-14). The number of EPT taxa was much lower than the BIOREF streams, whereas the number of Diptera was much higher. The majority of the macroinvertebrate taxa at all seven stations were Diptera. Chironomidae was the dominant Diptera and ranked as the dominant family present at all seven stations. The two most prevalent Chironomidae taxa, *Hydrobaenus* sp. and *Cricotopus/Orthocladius* made up at least 30 percent of taxa at all seven stations. The BI values of the two taxa are 9.6 and 6.5, respectively. The abundance of *Hydrobaenus* sp. contributed to the high percent of highly tolerant taxa present during the spring sampling period.

Throughout the course of studying Dardenne Creek, no water quality patterns have been observed that would cause impairment to the macroinvertebrate community. However, the datalogger deployment did indicate that DO does fall below the WQS minimum criteria of 5.0 mg/L, which would be expected to negatively affect the macroinvertebrate community if this were a persistent issue.

### **6.3 Comparison of 2014-2015 Data and Historical Data**

Low water conditions during fall 2002 resulted in no apparent surface flow at the three upstream sites, which affected the collection of coarse substrate and rootmat habitats. During the fall 2005 sampling season, the coarse substrate habitat was affected by low water conditions. When there is no or minimal flow, and there is little to no aeration of the water (such as occurs in riffle habitats), the DO levels can decline. However, the MSCI scores routinely do not rank optimally even during seasons when the water conditions are conducive to completely sampling all habitats.

### **6.4 Physicochemical Data**

The physicochemical data collected during the current sampling events did not reveal any notable trends that would indicate specific issues to be addressed. Although DO was above the WQS minimum concentration during *in situ* sampling, the values dropped below 5.0 mg/L during the data logger deployment of August 2014. Based on these data logger observations, it is expected that summer DO levels may routinely drop below the minimum criterion established in the WQS.

### **6.5 Benthic Fine Sediment Estimation**

As mentioned in Section 4.0, a benthic fine-sediment deposition-estimation study was to be conducted during the fall 2014-spring 2015 study period, but unsuitable conditions prevented it during that time. The estimation was completed during the summer of 2016. Similar to past sediment estimations, Dardenne Creek test stations contained higher percentages of benthic fine sediment than the control streams, and the downstream station contained the highest percentage of benthic fine sediment. As in the 2008-2009 study, stations 1 and 4 contained the highest benthic fine sediment, whereas the upstream stations contained lesser amounts. Station 2 had lower benthic fine sediment than stations 3 and 4.

When examining the benthic fine-sediment estimation results and the individual parameters of the habitat assessment, there is an indication that benthic fine sediment is likely an issue affecting the macroinvertebrate community of Dardenne Creek.

## **7.0 Summary**

The following six null hypotheses were examined:

- 1) Land cover characteristics in the Dardenne Creek watershed will be similar to the land cover characteristics of the Central Plains/Cuivre/Salt EDU.

This hypothesis is accepted. Land uses differed slightly between the study stream watershed and the EDU. The Dardenne Creek watershed contained a lower percentage of cropland and a higher percentage of forestland. The remaining parameters examined—non-vegetated, grassland, herbaceous cover, and wetland/open water—were similar between the study stream watershed and the EDU.

2) Stream habitat assessment scores in Dardenne Creek will be similar to South River, a BIOREF stream in the Central Plains/Cuivre/Salt EDU.

This hypothesis is accepted. There was little variation (scores ranged from 113 to 123) among the Dardenne Creek stations and between the stations and South River.

3) The macroinvertebrate community in Dardenne Creek will be similar among longitudinally separate reaches of Dardenne Creek.

This hypothesis is accepted for both seasons. During the fall sampling period, all stations of Dardenne Creek scored in the fully supporting category. During the spring sampling period, all Dardenne Creek stations scored in the partially supporting category. Although differences existed between the two seasons, the stations did score alike during each season.

4) The macroinvertebrate community in Dardenne Creek will be similar to the BIOREF streams in the Central Plains/Cuivre/Salt EDU.

This hypothesis is rejected. Reference streams represent the best available conditions and are the basis of biological criteria and MSCI scores. During the fall sampling period, all Dardenne test stations scored a 16; however, this is the lowest possible value for the fully supporting category. Both the EPT taxa and the BI metrics were consistently deficient during the fall. During the spring sampling season, all four metrics were deficient enough to prevent fully supporting status at any of the seven stations. When taking both seasons into consideration, Dardenne Creek would not be presumed to have a macroinvertebrate community that is similar to reference streams.

5) Physicochemical water quality in the surface water of Dardenne Creek will meet the Water Quality Standards of Missouri (MDNR 2014f).

This hypothesis is accepted with the exception that DO values fell below the minimum criteria of 5.0 mg/L at station 3 during data logger deployment in August of 2014.

6) Benthic fine sediment coverage of Dardenne Creek will be similar to benthic fine coverage of the eight control streams located in the Central Plains/Cuivre/Salt EDU.

This hypothesis is rejected. Kruskal-Wallis one way ANOVA determined four of the seven stations on Dardenne Creek to be significantly different ( $p < 0.05$ ) than the eight control stations examined.

## 8.0 Conclusion

One consistent feature of the Dardenne Creek watershed is the increase in development that has occurred over the past few decades (USACE 2007; Li and Wang 2009). According to population trends reported by Missouri's Office of Administration, St. Charles County was ranked as the fourth most populous county in Missouri in 2000 and is expected to grow to nearly 500,000 people by 2030. From 1982 to 2003, a 27.3% increase in urbanization occurred throughout the Dardenne Creek watershed, dominating the lower extent of the watershed and moving into the upper portion of the watershed (Li and Wang 2009). MoDNR's focus on Dardenne Creek bioassessments has been the upper portion of the watershed, which is dominated by housing communities interspersed with cropland and agricultural lands. Increased development has resulted in >48 percent increase in surface water runoff in the upper portion of the Dardenne Creek watershed and >95 percent increase in surface water runoff in the lower portion between 1982 and 2003 (Li and Wang 2009).

Overall, when considering the history of biological assessment studies on this reach of Dardenne Creek, the assessments indicate that this section of the creek contains a macroinvertebrate community that routinely attains suboptimal MSCI scores. MoDNR's evaluation of the upper portion of the Dardenne Creek watershed commenced in 2002, many years after the increase of development began affecting the water quality. Legacy land use may be a factor affecting the macroinvertebrate community. As previously stated, MoDNR's initial concern was due to increased urbanization in the watershed. Development in the area has continued to expand since the initial 2002 study. According to the U.S. Census Bureau, the population of St. Charles County has grown from 144,000 in 1980 to almost 385,000 in 2015. Impervious surfaces increase the amount of storm water, which often contains sediment and pollutants that have accumulated in the storm water coming from paved streets and parking lots, rooftops, manicured lawns, etc. (Lenat and Crawford 1994; Paul and Meyer 2001; Walsh et al. 2005). Not only does population growth increase impervious surface coverage within watersheds, but also loading from point source discharges also increases to accommodate growth (Paul and Meyer 2001).

Although actions (such as best management practices to mitigate construction effects) have been taken in recent years to minimize the effects of active development, the macroinvertebrate community may be suffering from long term effects of landscape alterations that have been taking place for several decades (Harding et al. 1998). It may only take a fragment of time to alter the surrounding landscape; however it may take much longer for the macroinvertebrate community to recover (Harding et al. 1998).

Considering the bioassessments collectively, Dardenne Creek appears to be capable of occasionally supporting its protection of warm water aquatic life designated use. During the spring of 2009, five of the seven samples had fully supporting scores, and during the fall of 2014, all seven samples were considered fully supporting. However, it is difficult to deduce the decline in MSCI scores during spring 2015 when all stations scored partially supporting. A high amount of tolerant taxa were collected, a majority of those



being tolerant Chironomidae, *Hydrobaenus* sp. in particular (this taxon was not as prevalent in the BIOREF data collected in the past). Water chemistry analyses did not show anything specific of concern, nor was the weather extreme prior to sampling. At this point, it is difficult to determine if the watershed of Dardenne Creek is demonstrating any trends relative to water quality and the macroinvertebrate community.

A Dardenne Creek Watershed Alliance Group was established in 1999 and produced the Dardenne Creek Greenway Conceptual Plan in 2001. The goal of the plan was to improve water quality and develop storm water management and park management near the creek. The emphasis on watershed improvements should continue and focus on the Dardenne Creek watershed as a whole in addition to public education about the watershed and ways to protect it.

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## **Appendix A**

Invertebrate Database Bench Sheet Report:  
Dardenne Creek, St. Charles Co, MO  
Grouped by Season and Station

## **Fall 2014 Data**

Aquid Invertebrate Database Bench Sheet Report

Dardenne Cr [14916], Station #1a, Sample Date: 9/25/2014 8:40:00 AM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

| ORDER: TAXA             | CS | NF | RM  |
|-------------------------|----|----|-----|
| <b>"HYDRACARINA"</b>    |    |    |     |
| Acarina                 | 4  | 1  | 34  |
| <b>AMPHIPODA</b>        |    |    |     |
| Gammarus                | 3  | 1  |     |
| <b>ARHYNCHOBDELLIDA</b> |    |    |     |
| Erpobdellidae           |    |    | -99 |
| <b>BASOMMATOPHORA</b>   |    |    |     |
| Ancylidae               | 1  |    | 1   |
| Menetus                 |    |    | 4   |
| Physella                |    |    | 1   |
| <b>COLEOPTERA</b>       |    |    |     |
| Ancyronyx variegatus    |    |    | 2   |
| Berosus                 | 1  |    | 8   |
| Dubiraphia              | 1  | 6  | 20  |
| Helichus lithophilus    | 1  |    | 1   |
| Macronychus glabratus   |    | 1  | 1   |
| Paracymus               |    |    | 1   |
| Stenelmis               | 34 | 1  |     |
| <b>DIPTERA</b>          |    |    |     |
| Ablabesmyia             |    | 28 | 7   |
| Ceratopogoninae         |    | 2  | 2   |
| Chironomus              |    | 9  |     |
| Cladotanytarsus         | 12 | 15 | 1   |
| Corynoneura             | 1  |    |     |
| Cricotopus bicinctus    | 18 |    | 5   |
| Cricotopus/Orthocladius | 30 | 4  | 3   |
| Cryptochironomus        | 1  | 7  |     |
| Cryptotendipes          |    | 2  |     |
| Dicrotendipes           | 2  | 7  | 1   |
| Diptera                 |    | 1  |     |
| Eukiefferiella          | 1  |    |     |
| Glyptotendipes          |    | 1  |     |
| Hemerodromia            | 3  |    |     |
| Hexatoma                | 2  |    |     |
| Labrundinia             |    |    | 6   |
| Microtendipes           | 1  | 1  |     |
| Nanocladius             | 1  |    |     |



Aquid Invertebrate Database Bench Sheet Report

Dardenne Cr [14916], Station #1a, Sample Date: 9/25/2014 8:40:00 AM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

| ORDER: TAXA                | CS  | NF | RM  |
|----------------------------|-----|----|-----|
| Paracladopelma             |     | 2  |     |
| Paralauterborniella        |     | 2  |     |
| Parametriocnemus           | 1   |    |     |
| Paratanytarsus             |     |    | 20  |
| Paratendipes               |     | 8  | 1   |
| Pentaneura                 | 1   |    |     |
| Phaenopsectra              |     | 5  | 2   |
| Polypedilum flavum         | 59  |    | 15  |
| Polypedilum halterale grp  | 5   | 9  |     |
| Polypedilum illinoense grp | 6   |    | 4   |
| Polypedilum ontario        |     |    | 1   |
| Polypedilum scalaenum grp  | 34  | 25 |     |
| Pseudochironomus           |     | 3  |     |
| Rheotanytarsus             | 43  | 3  | 32  |
| Saetheria                  | 4   | 1  |     |
| Simulium                   | 30  | 1  | 1   |
| Stempellinella             | 2   | 2  | 3   |
| Stictochironomus           | 2   | 9  |     |
| Tabanus                    | -99 |    |     |
| Tanytarsus                 | 24  | 63 | 42  |
| Thienemanniella            | 8   | 1  | 3   |
| Thienemannimyia grp.       | 3   |    | 6   |
| EPHEMEROPTERA              |     |    |     |
| Acentrella                 | 1   |    |     |
| Acerpenna                  | 34  |    |     |
| Apobaetis                  |     | 3  |     |
| Baetis                     | 68  |    | 1   |
| Caenis latipennis          | 5   | 9  | 31  |
| Centroptilum               |     | 2  |     |
| Procloeon                  |     | 8  |     |
| Stenacron                  |     |    | 2   |
| Stenonema femoratum        | 16  | 20 |     |
| Tricorythodes              | 13  |    | 5   |
| ISOPODA                    |     |    |     |
| Caecidotea                 | 1   |    |     |
| ODONATA                    |     |    |     |
| Argia                      |     |    | 20  |
| Basiaeschna janata         |     |    | -99 |

Aquid Invertebrate Database Bench Sheet Report

Dardenne Cr [14916], Station #1a, Sample Date: 9/25/2014 8:40:00 AM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

| ORDER: TAXA         | CS | NF | RM  |
|---------------------|----|----|-----|
| Calopterygidae      |    | 1  |     |
| Calopteryx          |    |    | 1   |
| Dromogomphus        |    |    | -99 |
| Enallagma           |    |    | 35  |
| Libellula           |    | 1  | 1   |
| Progomphus obscurus |    | 1  |     |
| TRICHOPTERA         |    |    |     |
| Cheumatopsyche      | 87 | 1  | 18  |
| Chimarra            | 16 | 1  | 6   |
| Hydropsyche         | 14 |    |     |
| Hydroptila          | 1  | 1  |     |
| Triaenodes          |    |    | 2   |
| TUBIFICIDA          |    |    |     |
| Branchiura sowerbyi | 1  |    |     |
| Enchytraeidae       |    |    | 1   |
| Tubificidae         | 5  | 8  | 2   |
| VENEROIDA           |    |    |     |
| Corbicula           | 3  | 3  | 3   |

Aquid Invertebrate Database Bench Sheet Report

Dardenne Cr [14917], Station #1b, Sample Date: 9/25/2014 8:40:00 AM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

| ORDER: TAXA           | CS | NF | RM  |
|-----------------------|----|----|-----|
| "HYDRACARINA"         |    |    |     |
| Acarina               | 11 | 4  | 42  |
| AMPHIPODA             |    |    |     |
| Gammarus              | 4  | 1  |     |
| Hyaella azteca        |    |    | 2   |
| ARHYNCHOBDELLIDA      |    |    |     |
| Erpobdellidae         |    |    | -99 |
| BASOMMATOPHORA        |    |    |     |
| Ancylidae             | 7  |    |     |
| Lymnaeidae            |    | 1  |     |
| COLEOPTERA            |    |    |     |
| Ancyronyx variegatus  |    |    | 1   |
| Berosus               |    | 7  | 9   |
| Dubiraphia            |    | 3  | 8   |
| Macronychus glabratus | 1  |    | 2   |

Aquid Invertebrate Database Bench Sheet Report

Dardenne Cr [14917], Station #1b, Sample Date: 9/25/2014 8:40:00 AM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

| ORDER: TAXA                | CS  | NF | RM |
|----------------------------|-----|----|----|
| Stenelmis                  | 51  | 2  | 3  |
| DIPTERA                    |     |    |    |
| Ablabesmyia                | 1   | 26 | 4  |
| Ceratopogoninae            |     | 6  |    |
| Chironomidae               |     | 2  |    |
| Chironomus                 |     | 2  |    |
| Cladotanytarsus            | 8   | 28 | 2  |
| Cricotopus bicinctus       | 6   |    | 2  |
| Cricotopus/Orthocladius    | 44  | 4  | 6  |
| Cryptochironomus           | 3   | 9  |    |
| Cryptotendipes             |     | 1  |    |
| Dicrotendipes              |     | 2  |    |
| Diptera                    |     | 1  |    |
| Hemerodromia               | 2   |    | 1  |
| Hexatoma                   | -99 |    |    |
| Labrundinia                |     |    | 5  |
| Mesosmittia                |     |    | 1  |
| Microtendipes              |     | 1  | 2  |
| Nanocladius                |     |    | 2  |
| Nilotanypus                | 1   |    | 1  |
| Paracladopelma             |     | 3  |    |
| Paralauterborniella        |     | 1  |    |
| Parametriocnemus           | 2   |    |    |
| Paratanytarsus             | 4   | 2  | 35 |
| Paratendipes               |     | 3  |    |
| Phaenopsectra              |     | 2  |    |
| Polypedilum fallax grp     | 1   |    |    |
| Polypedilum flavum         | 66  | 1  | 12 |
| Polypedilum halterale grp  | 1   | 14 |    |
| Polypedilum illinoense grp | 4   | 3  | 3  |
| Polypedilum ontario        | 1   |    |    |
| Polypedilum scalaenum grp  | 17  | 22 |    |
| Rheotanytarsus             | 33  | 2  | 15 |
| Saetheria                  |     | 2  |    |
| Simulium                   | 28  |    | 3  |
| Stempellinella             |     | 6  | 4  |
| Stictochironomus           | 2   | 30 |    |
| Tabanus                    | 2   |    |    |

Aquid Invertebrate Database Bench Sheet Report

Dardenne Cr [14917], Station #1b, Sample Date: 9/25/2014 8:40:00 AM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

| ORDER: TAXA              | CS  | NF  | RM  |
|--------------------------|-----|-----|-----|
| Tanytarsus               | 27  | 62  | 46  |
| Thienemanniella          | 5   |     |     |
| Thienemannimyia grp.     |     | 2   | 2   |
| Tribelos                 |     | 3   |     |
| EPHEMEROPTERA            |     |     |     |
| Acentrella               | 5   |     |     |
| Acerpenna                | 57  |     | 4   |
| Apobaetis                |     | 1   |     |
| Baetis                   | 93  |     | 2   |
| Caenis latipennis        | 9   | 9   | 35  |
| Centroptilum             |     | 3   |     |
| Procloeon                |     | 12  |     |
| Stenacron                |     | 1   |     |
| Stenonema femoratum      | 28  | 21  | 2   |
| Tricorythodes            | 14  | 1   | 7   |
| MEGALOPTERA              |     |     |     |
| Sialis                   |     | -99 |     |
| ODONATA                  |     |     |     |
| Argia                    |     |     | 24  |
| Basiaeschna janata       |     |     | -99 |
| Calopteryx               |     |     | 1   |
| Enallagma                |     | 1   | 31  |
| Epitheca (Epicordulia)   |     |     | 1   |
| Gomphus                  |     |     | -99 |
| Hetaerina                | 3   |     | 3   |
| Progomphus obscurus      |     | 1   |     |
| RHYNCHOBDELLIDA          |     |     |     |
| Glossiphoniidae          |     | -99 |     |
| TRICHOPTERA              |     |     |     |
| Cheumatopsyche           | 115 | 1   | 15  |
| Chimarra                 | 13  |     | 2   |
| Hydropsyche              | 9   |     |     |
| Hydroptila               | 1   |     | 1   |
| Triaenodes               |     |     | 6   |
| TRICLADIDA               |     |     |     |
| Planariidae              | 3   |     |     |
| TUBIFICIDA               |     |     |     |
| Limnodrilus hoffmeisteri | 1   |     |     |

Aquid Invertebrate Database Bench Sheet Report

Dardenne Cr [14917], Station #1b, Sample Date: 9/25/2014 8:40:00 AM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

| ORDER: TAXA | CS | NF | RM |
|-------------|----|----|----|
| Tubificidae | 5  | 11 | 1  |
| VENEROIDA   |    |    |    |
| Corbicula   | 12 | 18 | 4  |

Aquid Invertebrate Database Bench Sheet Report

Dardenne Cr [14918], Station #2, Sample Date: 9/29/2014 9:40:00 AM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

| ORDER: TAXA             | CS  | NF | RM |
|-------------------------|-----|----|----|
| "HYDRACARINA"           |     |    |    |
| Acarina                 | 7   | 15 | 23 |
| AMPHIPODA               |     |    |    |
| Hyaella azteca          |     |    | 14 |
| BASOMMATOPHORA          |     |    |    |
| Ancylidae               | 2   |    | 1  |
| Helisoma                | -99 |    | 5  |
| Menetus                 |     |    | 14 |
| Physella                |     |    | 3  |
| COLEOPTERA              |     |    |    |
| Berosus                 |     | 7  | 12 |
| Dubiraphia              |     | 3  | 53 |
| Helichus lithophilus    |     |    | 1  |
| Laccobius               | 1   |    |    |
| Macronychus glabratus   |     |    | 1  |
| Stenelmis               | 19  | 2  |    |
| DIPTERA                 |     |    |    |
| Ablabesmyia             | 3   | 34 | 16 |
| Anopheles               |     | 2  | 3  |
| Ceratopogoninae         | 8   | 5  |    |
| Chironomidae            | 2   | 4  |    |
| Chironomus              |     | 6  |    |
| Cladotanytarsus         | 11  | 12 |    |
| Corynoneura             | 1   | 6  |    |
| Cricotopus bicinctus    | 9   | 3  | 8  |
| Cricotopus/Orthocladius | 47  | 3  | 4  |
| Cryptochironomus        | 1   | 13 |    |
| Dicrotendipes           |     | 8  | 1  |
| Djalmabatista           |     | 1  |    |
| Glyptotendipes          |     | 3  | 1  |

Aquid Invertebrate Database Bench Sheet Report

Dardenne Cr [14918], Station #2, Sample Date: 9/29/2014 9:40:00 AM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

| ORDER: TAXA                | CS  | NF | RM |
|----------------------------|-----|----|----|
| Hemerodromia               | 4   |    |    |
| Hexatoma                   | -99 |    |    |
| Labrundinia                |     | 2  | 11 |
| Microtendipes              | 1   | 1  |    |
| Nilotanypus                | 11  | 2  | 1  |
| Ormosia                    |     | 1  |    |
| Paracladopelma             |     | 2  | 1  |
| Paralauterborniella        |     | 1  |    |
| Parametriocnemus           | 1   |    |    |
| Paratanytarsus             | 2   | 10 | 23 |
| Paratendipes               |     |    | 1  |
| Phaenopsectra              |     | 1  |    |
| Polypedilum flavum         | 134 |    | 1  |
| Polypedilum halterale grp  |     | 4  |    |
| Polypedilum illinoense grp | 16  | 14 | 5  |
| Polypedilum scalaenum grp  | 3   | 3  |    |
| Procladius                 |     |    | 1  |
| Pseudochironomus           |     | 2  |    |
| Rheocricotopus             | 1   |    |    |
| Rheotanytarsus             | 31  | 3  | 10 |
| Simulium                   | 47  |    |    |
| Stempellinella             |     | 3  | 1  |
| Stictochironomus           |     | 26 |    |
| Tabanus                    | 1   |    |    |
| Tanytarsus                 | 4   | 41 | 20 |
| Thienemanniella            | 14  | 1  |    |
| Thienemannimyia grp.       | 5   | 4  | 2  |
| Tipula                     |     | 1  |    |
| Tribelos                   |     | 5  | 4  |
| EPHEMEROPTERA              |     |    |    |
| Acerpenna                  | 15  | 2  | 2  |
| Baetis                     | 72  | 1  |    |
| Caenis latipennis          | 3   | 17 | 62 |
| Centroptilum               |     | 6  |    |
| Stenacron                  |     | 1  |    |
| Stenonema femoratum        | 8   | 13 | 5  |
| Tricorythodes              | 1   |    |    |
| MEGALOPTERA                |     |    |    |

Aquid Invertebrate Database Bench Sheet Report

Dardenne Cr [14918], Station #2, Sample Date: 9/29/2014 9:40:00 AM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

| ORDER: TAXA          | CS  | NF  | RM  |
|----------------------|-----|-----|-----|
| Sialis               |     | -99 |     |
| ODONATA              |     |     |     |
| Argia                | 1   | 1   | 9   |
| Basiaeschna janata   |     | -99 | 1   |
| Enallagma            |     | 5   | 84  |
| Hagenius brevistylus |     | 1   | -99 |
| Hetaerina            |     |     | 2   |
| PLECOPTERA           |     |     |     |
| Perlidae             | 1   |     |     |
| TRICHOPTERA          |     |     |     |
| Cheumatopsyche       | 204 | 2   | 1   |
| Chimarra             | 16  |     |     |
| Helicopsyche         | 2   |     |     |
| Hydroptila           | 2   |     |     |
| Triaenodes           |     |     | 2   |
| TRICLADIDA           |     |     |     |
| Planariidae          | 1   |     | 6   |
| TUBIFICIDA           |     |     |     |
| Branchiura sowerbyi  |     | 1   | 2   |
| Enchytraeidae        |     | 1   |     |
| Tubificidae          | 7   | 32  | 1   |
| VENEROIDA            |     |     |     |
| Corbicula            | 13  |     | 1   |
| Pisidiidae           | 1   |     |     |

Aquid Invertebrate Database Bench Sheet Report

Dardenne Cr [14919], Station #3, Sample Date: 9/29/2014 11:20:00 AM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

| ORDER: TAXA    | CS  | NF | RM |
|----------------|-----|----|----|
| "HYDRACARINA"  |     |    |    |
| Acarina        |     |    | 6  |
| AMPHIPODA      |     |    |    |
| Crangonyx      | -99 |    |    |
| Hyaella azteca |     |    | 6  |
| BASOMMATOPHORA |     |    |    |
| Helisoma       | 2   |    | 3  |
| Menetus        |     | 1  |    |
| COLEOPTERA     |     |    |    |

Aquid Invertebrate Database Bench Sheet Report

Dardenne Cr [14919], Station #3, Sample Date: 9/29/2014 11:20:00 AM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

| ORDER: TAXA                | CS  | NF  | RM |
|----------------------------|-----|-----|----|
| Berosus                    |     | -99 | 7  |
| Dubiraphia                 |     | 1   | 2  |
| Stenelmis                  | 107 | 15  | 3  |
| DIPTERA                    |     |     |    |
| Ablabesmyia                |     | 30  | 22 |
| Ceratopogoninae            | 2   | 19  |    |
| Chironomidae               | 2   | 13  | 4  |
| Chironomus                 |     | 10  | 3  |
| Chrysops                   |     | -99 |    |
| Cladotanytarsus            | 1   | 11  |    |
| Corynoneura                | 5   |     | 4  |
| Cricotopus bicinctus       | 6   |     | 30 |
| Cricotopus/Orthocladius    | 17  | 1   | 17 |
| Cryptochironomus           | 1   | 5   |    |
| Dicrotendipes              |     | 18  | 2  |
| Diptera                    |     | 1   |    |
| Glyptotendipes             |     | 1   | 9  |
| Hemerodromia               | 1   | 1   | 1  |
| Hexatoma                   | 1   | 1   |    |
| Labrundinia                | 3   | 5   | 14 |
| Microtendipes              | 1   | 3   | 2  |
| Nanocladius                | 3   |     | 1  |
| Parakiefferiella           |     |     | 1  |
| Parametriocnemus           | 1   |     |    |
| Paratanytarsus             | 3   | 5   | 42 |
| Pentaneura                 | 5   | 1   |    |
| Phaenopsectra              |     |     | 1  |
| Polypedilum fallax grp     |     |     | 1  |
| Polypedilum flavum         | 131 |     | 12 |
| Polypedilum halterale grp  |     | 2   |    |
| Polypedilum illinoense grp | 5   | 7   | 16 |
| Polypedilum scalaenum grp  | 3   | 14  | 1  |
| Pseudochironomus           |     | 2   |    |
| Rheocricotopus             | 3   |     |    |
| Rheotanytarsus             | 20  |     | 33 |
| Simulium                   | 49  |     | 3  |
| Stempellinella             | 1   | 3   |    |
| Stictochironomus           |     | 37  |    |



Aquid Invertebrate Database Bench Sheet Report

Dardenne Cr [14919], Station #3, Sample Date: 9/29/2014 11:20:00 AM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

| ORDER: TAXA                      | CS  | NF  | RM |
|----------------------------------|-----|-----|----|
| Tanytarsus                       | 12  | 41  | 40 |
| Thienemanniella                  | 30  |     | 10 |
| Thienemannimyia grp.             | 5   | 1   | 3  |
| Tipula                           | 1   |     |    |
| Tribelos                         |     | 5   |    |
| EPHEMEROPTERA                    |     |     |    |
| Acentrella                       | 3   |     |    |
| Acerpenna                        | 20  |     | 3  |
| Baetis                           | 35  |     |    |
| Caenis latipennis                | 15  | 4   | 50 |
| Centropilum                      |     | 3   | 1  |
| Procloeon                        |     | 2   | 1  |
| Stenacron                        | 1   |     |    |
| Stenonema femoratum              | 17  | 7   | 5  |
| Tricorythodes                    |     |     | 2  |
| ISOPODA                          |     |     |    |
| Caecidotea                       | 1   | -99 |    |
| Caecidotea (Blind & Unpigmented) | 1   |     |    |
| LUMBRICINA                       |     |     |    |
| Lumbricina                       |     | -99 |    |
| MEGALOPTERA                      |     |     |    |
| Corydalus                        | -99 |     |    |
| ODONATA                          |     |     |    |
| Argia                            | 1   |     | 1  |
| Calopteryx                       |     |     | 1  |
| Enallagma                        |     | -99 | 24 |
| Epitheca (Epicordulia)           |     |     | 1  |
| Somatochlora                     |     | -99 |    |
| TRICHOPTERA                      |     |     |    |
| Cheumatopsyche                   | 117 |     | 19 |
| Chimarra                         | 11  |     | 1  |
| Hydroptila                       |     |     | 2  |
| Triaenodes                       |     |     | 1  |
| TRICLADIDA                       |     |     |    |
| Planariidae                      | 3   |     |    |
| TUBIFICIDA                       |     |     |    |
| Aulodrilus                       | 2   | 2   |    |
| Branchiura sowerbyi              |     | 1   |    |

Aquid Invertebrate Database Bench Sheet Report

Dardenne Cr [14919], Station #3, Sample Date: 9/29/2014 11:20:00 AM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

| ORDER: TAXA | CS  | NF | RM  |
|-------------|-----|----|-----|
| Tubificidae | 1   | 20 |     |
| VENEROIDA   |     |    |     |
| Corbicula   | -99 | 8  | -99 |

Aquid Invertebrate Database Bench Sheet Report

Dardenne Cr [14922], Station #4, Sample Date: 9/30/2014 8:46:00 AM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

| ORDER: TAXA             | CS | NF | RM |
|-------------------------|----|----|----|
| "HYDRACARINA"           |    |    |    |
| Acarina                 |    | 11 | 2  |
| AMPHIPODA               |    |    |    |
| Hyaella azteca          |    |    | 4  |
| ARHYNCHOBDELLIDA        |    |    |    |
| Erpobdellidae           |    | 1  |    |
| BASOMMATOPHORA          |    |    |    |
| Ancylidae               |    | 1  | 1  |
| Menetus                 |    |    | 4  |
| COLEOPTERA              |    |    |    |
| Berosus                 |    | 1  | 4  |
| Dubiraphia              |    |    | 11 |
| Dytiscidae              |    | 2  |    |
| Helichus lithophilus    | 1  |    | 3  |
| Stenelmis               | 14 | 10 | 4  |
| DECAPODA                |    |    |    |
| Orconectes virilis      |    |    | 1  |
| DIPTERA                 |    |    |    |
| Ablabesmyia             | 10 | 30 | 9  |
| Anopheles               | 1  |    | 6  |
| Ceratopogoninae         |    | 8  |    |
| Chironomus              |    | 4  |    |
| Cladotanytarsus         | 6  | 15 | 1  |
| Corynoneura             | 7  |    | 5  |
| Cricotopus bicinctus    | 1  |    | 2  |
| Cricotopus/Orthocladius | 8  | 1  | 4  |
| Cryptochironomus        |    | 11 | 1  |
| Dicrotendipes           | 1  | 5  | 2  |
| Glyptotendipes          |    | 3  | 2  |
| Hexatoma                | 4  |    |    |

Aquid Invertebrate Database Bench Sheet Report

Dardenne Cr [14922], Station #4, Sample Date: 9/30/2014 8:46:00 AM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

| ORDER: TAXA                | CS | NF | RM |
|----------------------------|----|----|----|
| Labrundinia                | 3  | 2  | 3  |
| Microtendipes              | 1  | 5  |    |
| Nilotanytus                | 12 |    |    |
| Ormosia                    | 3  |    |    |
| Paracladopelma             |    | 1  |    |
| Parametriocnemus           | 1  |    |    |
| Paratanytarsus             | 3  | 1  | 57 |
| Paratendipes               |    | 6  | 1  |
| Pentaneura                 | 6  |    |    |
| Phaenopsectra              |    | 1  | 1  |
| Polypedilum flavum         | 85 |    |    |
| Polypedilum halterale grp  |    | 14 |    |
| Polypedilum illinoense grp | 14 | 1  | 4  |
| Polypedilum scalaenum grp  | 2  | 39 |    |
| Polypedilum tritum         |    |    | 1  |
| Pseudochironomus           |    | 3  |    |
| Rheotanytarsus             | 11 |    | 1  |
| Saetheria                  | 1  |    |    |
| Simulium                   | 26 |    |    |
| Stempellinella             | 2  | 8  | 1  |
| Stictochironomus           | 1  | 95 |    |
| Tabanus                    |    | 1  |    |
| Tanytarsus                 | 7  | 37 | 11 |
| Thienemanniella            | 30 |    | 3  |
| Thienemannimyia grp.       | 8  | 1  | 2  |
| Tribelos                   |    | 4  |    |
| EPHEMEROPTERA              |    |    |    |
| Acerpenna                  | 11 |    | 1  |
| Apobaetis                  |    | 1  |    |
| Baetis                     | 56 |    |    |
| Caenis latipennis          | 24 | 16 | 85 |
| Centroptilum               |    | 4  |    |
| Stenacron                  | 1  |    |    |
| Stenonema femoratum        | 32 | 15 | 5  |
| GORDIOIDEA                 |    |    |    |
| Chordodidae                | 1  |    |    |
| HEMIPTERA                  |    |    |    |
| Belostoma                  | 1  |    |    |

Aquid Invertebrate Database Bench Sheet Report

Dardenne Cr [14922], Station #4, Sample Date: 9/30/2014 8:46:00 AM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

| ORDER: TAXA              | CS  | NF | RM  |
|--------------------------|-----|----|-----|
| Microvelia               | 3   |    |     |
| LUMBRICULIDA             |     |    |     |
| Lumbriculidae            |     |    | -99 |
| ODONATA                  |     |    |     |
| Argia                    | 1   | 1  | 9   |
| Basiaeschna janata       |     |    | 1   |
| Calopteryx               |     |    | 3   |
| Enallagma                |     | 1  | 42  |
| Epithea (Tetragoneuria)  |     |    | -99 |
| Hetaerina                | 1   |    |     |
| Ischnura                 |     |    | 1   |
| TRICHOPTERA              |     |    |     |
| Cheumatopsyche           | 101 |    |     |
| Chimarra                 | 12  |    |     |
| Triaenodes               |     |    | 7   |
| TRICLADIDA               |     |    |     |
| Planariidae              |     |    | 3   |
| TUBIFICIDA               |     |    |     |
| Branchiura sowerbyi      |     | 3  |     |
| Limnodrilus hoffmeisteri |     |    | 1   |
| Limnodrilus udekemianus  |     | 2  |     |
| Tubificidae              | 3   | 37 | 2   |
| VENEROIDA                |     |    |     |
| Corbicula                | 1   |    |     |
| Pisidiidae               |     | 1  |     |

Aquid Invertebrate Database Bench Sheet Report

Dardenne Cr [14921], Station #4.1, Sample Date: 9/30/2014 10:00:00 AM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

| ORDER: TAXA     | CS | NF | RM |
|-----------------|----|----|----|
| "HYDRACARINA"   |    |    |    |
| Acarina         | 1  |    | 6  |
| AMPHIPODA       |    |    |    |
| Hyalella azteca |    |    | 12 |
| BASOMMATOPHORA  |    |    |    |
| Ancylidae       |    |    | 6  |
| Menetus         |    |    | 4  |
| Physella        |    |    | 1  |

Aquid Invertebrate Database Bench Sheet Report

Dardenne Cr [14921], Station #4.1, Sample Date: 9/30/2014 10:00:00 AM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

| ORDER: TAXA                | CS  | NF | RM  |
|----------------------------|-----|----|-----|
| COLEOPTERA                 |     |    |     |
| Berosus                    | 2   | 1  | 7   |
| Dubiraphia                 |     | 8  | 13  |
| Helichus basalis           |     |    | 1   |
| Helichus lithophilus       |     |    | 1   |
| Stenelmis                  | 10  | 17 | 3   |
| DECAPODA                   |     |    |     |
| Orconectes                 |     |    | -99 |
| Orconectes luteus          | -99 |    |     |
| DIPTERA                    |     |    |     |
| Ablabesmyia                | 1   | 28 | 10  |
| Ceratopogoninae            |     | 23 | 1   |
| Chironomus                 |     | 3  |     |
| Cladopelma                 |     | 1  | 1   |
| Cladotanytarsus            | 3   | 13 |     |
| Corynoneura                |     | 2  | 4   |
| Cricotopus bicinctus       |     |    | 2   |
| Cricotopus/Orthocladius    | 30  | 2  | 4   |
| Cryptochironomus           | 2   | 5  |     |
| Dicrotendipes              |     | 10 | 2   |
| Glyptotendipes             |     |    | 3   |
| Hexatoma                   | 6   | 10 |     |
| Labrundinia                | 7   | 5  | 7   |
| Microtendipes              | 3   | 5  |     |
| Nanocladius                |     |    | 2   |
| Nilotanypus                | 3   |    |     |
| Ormosia                    |     | 1  |     |
| Paracladopelma             |     | 2  |     |
| Paratanytarsus             | 1   | 3  | 23  |
| Paratendipes               |     | 2  |     |
| Phaenopsectra              |     | 1  |     |
| Polypedilum aviceps        | 3   |    |     |
| Polypedilum flavum         | 119 | 2  | 4   |
| Polypedilum halterale grp  |     | 5  |     |
| Polypedilum illinoense grp |     | 1  | 6   |
| Polypedilum scalaenum grp  | 12  | 13 |     |
| Procladius                 |     | 4  |     |
| Pseudochironomus           |     | 1  | 2   |

Aquid Invertebrate Database Bench Sheet Report

Dardenne Cr [14921], Station #4.1, Sample Date: 9/30/2014 10:00:00 AM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

| ORDER: TAXA          | CS  | NF  | RM  |
|----------------------|-----|-----|-----|
| Rheocricotopus       | 2   |     |     |
| Rheotanytarsus       | 7   |     | 1   |
| Simulium             | 38  |     |     |
| Stempellinella       | 4   | 8   | 1   |
| Stictochironomus     | 1   | 18  |     |
| Tanytarsus           | 19  | 45  | 10  |
| Thienemanniella      | 25  | 1   | 7   |
| Thienemannimyia grp. | 8   | 2   | 8   |
| Tribelos             |     |     | 2   |
| EPHEMEROPTERA        |     |     |     |
| Acerpenna            | 21  |     | 2   |
| Baetis               | 100 |     | 2   |
| Caenis latipennis    | 22  | 25  | 107 |
| Callibaetis          | 2   |     |     |
| Centroptilum         |     | 1   |     |
| Procloeon            |     | 5   | 1   |
| Stenacron            | 5   | 2   |     |
| Stenonema femoratum  | 25  | 30  | 15  |
| HEMIPTERA            |     |     |     |
| Microvelia           | 1   |     |     |
| MEGALOPTERA          |     |     |     |
| Corydalus            | -99 |     |     |
| ODONATA              |     |     |     |
| Argia                |     | 2   | 8   |
| Corduliidae          |     | 1   |     |
| Enallagma            |     |     | 25  |
| Gomphidae            |     | 1   |     |
| Hagenius brevistylus |     |     | 1   |
| Somatochlora         |     | -99 | 2   |
| PLECOPTERA           |     |     |     |
| Capniidae            | 1   |     |     |
| TRICHOPTERA          |     |     |     |
| Cheumatopsyche       | 173 | 1   | 5   |
| Chimarra             | 43  |     | 1   |
| Polycentropus        |     | 2   |     |
| Triaenodes           |     |     | 3   |
| TUBIFICIDA           |     |     |     |
| Branchiura sowerbyi  |     | 2   | 1   |

Aquid Invertebrate Database Bench Sheet Report

Dardenne Cr [14921], Station #4.1, Sample Date: 9/30/2014 10:00:00 AM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

| ORDER: TAXA              | CS | NF | RM |
|--------------------------|----|----|----|
| Limnodrilus hoffmeisteri |    | 1  |    |
| Tubificidae              |    | 11 |    |
| VENEROIDA                |    |    |    |
| Pisidiidae               | 1  |    | 3  |

Aquid Invertebrate Database Bench Sheet Report

Dardenne Cr [14923], Station #4.9, Sample Date: 9/30/2014 12:00:00 PM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

| ORDER: TAXA             | CS | NF  | RM  |
|-------------------------|----|-----|-----|
| "HYDRACARINA"           |    |     |     |
| Acarina                 | 2  | 16  |     |
| AMPHIPODA               |    |     |     |
| Hyalella azteca         |    |     | 10  |
| ARHYNCHOBDELLIDA        |    |     |     |
| Erpobdellidae           |    |     | -99 |
| BASOMMATOPHORA          |    |     |     |
| Ancylidae               |    | 1   | 2   |
| COLEOPTERA              |    |     |     |
| Berosus                 |    | 2   | -99 |
| Dubiraphia              |    |     | 5   |
| Dytiscidae              |    |     | 2   |
| Paracymus               |    |     | 1   |
| Scirtidae               |    |     | 3   |
| Stenelmis               | 38 | 13  | 3   |
| Tropisternus            |    |     | -99 |
| DECAPODA                |    |     |     |
| Orconectes luteus       |    | -99 |     |
| DIPTERA                 |    |     |     |
| Ablabesmyia             | 1  | 46  | 2   |
| Anopheles               |    | 2   | 1   |
| Ceratopogoninae         |    | 11  |     |
| Chironomidae            | 2  | 9   | 4   |
| Chironomus              |    | 3   | 1   |
| Cladotanytarsus         |    | 3   |     |
| Corynoneura             | 14 |     | 4   |
| Cricotopus bicinctus    | 1  |     | 1   |
| Cricotopus/Orthocladius | 23 |     | 3   |
| Cryptochironomus        | 1  | 7   |     |

Aquid Invertebrate Database Bench Sheet Report

Dardenne Cr [14923], Station #4.9, Sample Date: 9/30/2014 12:00:00 PM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

| ORDER: TAXA                | CS | NF | RM  |
|----------------------------|----|----|-----|
| Dicrotendipes              | 2  |    |     |
| Diptera                    |    |    | 1   |
| Glyptotendipes             | 1  |    | 5   |
| Hemerodromia               | 1  |    |     |
| Hexatoma                   | 1  | 1  |     |
| Labrundinia                |    | 3  | 20  |
| Larsia                     | 1  |    |     |
| Micropsectra               |    |    | 1   |
| Microtendipes              | 2  | 17 | 2   |
| Nanocladius                | 1  | 1  | 1   |
| Nilotanypus                | 34 |    |     |
| Ormosia                    |    | 1  |     |
| Paracladopelma             |    | 1  |     |
| Parametriocnemus           | 1  |    | 1   |
| Paratanytarsus             | 4  | 1  | 20  |
| Paratendipes               |    | 1  |     |
| Pentaneura                 | 4  |    |     |
| Phaenopsectra              |    | 1  | 1   |
| Polypedilum flavum         | 78 |    | 5   |
| Polypedilum illinoense grp | 7  | 2  | 7   |
| Polypedilum scalaenum grp  | 14 | 1  | 1   |
| Pseudochironomus           |    | 1  |     |
| Rheocricotopus             | 6  |    |     |
| Rheotanytarsus             | 18 |    | 3   |
| Simuliidae                 | 1  |    |     |
| Stempellinella             | 5  | 21 | 1   |
| Stictochironomus           |    | 21 |     |
| Tabanus                    | 4  |    |     |
| Tanytarsus                 | 24 | 16 | 10  |
| Thienemanniella            | 39 |    | 1   |
| Thienemannimyia grp.       | 20 | 1  | 4   |
| Zavrelimyia                |    |    | 1   |
| <b>EPHEMEROPTERA</b>       |    |    |     |
| Acentrella                 | 7  |    |     |
| Acerpenna                  | 4  |    | 1   |
| Baetis                     | 37 |    |     |
| Caenis latipennis          | 77 | 73 | 149 |
| Procloeon                  |    | 16 | 1   |



Aquid Invertebrate Database Bench Sheet Report

Dardenne Cr [14923], Station #4.9, Sample Date: 9/30/2014 12:00:00 PM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

| ORDER: TAXA              | CS | NF | RM  |
|--------------------------|----|----|-----|
| Stenacron                | 6  | 4  | 3   |
| Stenonema femoratum      | 21 | 62 | 11  |
| HEMIPTERA                |    |    |     |
| Ranatra                  |    |    | -99 |
| LUMBRICINA               |    |    |     |
| Lumbricina               |    | 1  |     |
| ODONATA                  |    |    |     |
| Argia                    | 1  | 2  | 5   |
| Calopteryx               |    |    | 2   |
| Enallagma                |    |    | 8   |
| Epitheca (Tetragoneuria) |    |    | 1   |
| Libellula                |    |    | 1   |
| PLECOPTERA               |    |    |     |
| Perlidae                 | 1  |    |     |
| TRICHOPTERA              |    |    |     |
| Cheumatopsyche           | 89 |    | 21  |
| Chimarra                 | 17 |    | 2   |
| Hydropsyche              | 1  |    |     |
| Polycentropus            |    | 3  |     |
| Triaenodes               |    |    | 7   |
| TRICLADIDA               |    |    |     |
| Planariidae              |    |    | 2   |
| TUBIFICIDA               |    |    |     |
| Branchiura sowerbyi      |    | 9  |     |
| Enchytraeidae            | 1  |    |     |
| Tubificidae              |    | 24 | 2   |

Aquid Invertebrate Database Bench Sheet Report

Dardenne Cr [14920], Station #6.1, Sample Date: 9/29/2014 2:20:00 PM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

| ORDER: TAXA      | CS  | NF | RM |
|------------------|-----|----|----|
| "HYDRACARINA"    |     |    |    |
| Acarina          |     | 4  | 2  |
| AMPHIPODA        |     |    |    |
| Hyaella azteca   |     | 2  | 5  |
| ARHYNCHOBDELLIDA |     |    |    |
| Erpobdellidae    | -99 |    |    |
| BASOMMATOPHORA   |     |    |    |

Aquid Invertebrate Database Bench Sheet Report

Dardenne Cr [14920], Station #6.1, Sample Date: 9/29/2014 2:20:00 PM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

| ORDER: TAXA             | CS  | NF | RM |
|-------------------------|-----|----|----|
| Ancylidae               | 1   | 2  |    |
| Lymnaeidae              |     |    | 1  |
| Menetus                 |     | 1  | 1  |
| Physella                | 1   | 6  | 7  |
| Planorbella             |     | 1  |    |
| COLEOPTERA              |     |    |    |
| Berosus                 |     | 1  | 1  |
| Dubiraphia              |     | 2  | 6  |
| Dytiscidae              |     | 3  | 1  |
| Peltodytes              |     |    | 1  |
| Stenelmis               | 36  | 8  | 2  |
| DECAPODA                |     |    |    |
| Orconectes virilis      |     | 1  |    |
| DIPTERA                 |     |    |    |
| Ablabesmyia             | 7   | 26 | 11 |
| Ceratopogoninae         |     | 1  |    |
| Chironomidae            | 10  |    | 20 |
| Chironomus              | 4   | 41 | 4  |
| Cladotanytarsus         | 1   | 6  | 1  |
| Corynoneura             | 12  | 2  |    |
| Cricotopus bicinctus    | 1   | 1  |    |
| Cricotopus/Orthocladius | 10  |    |    |
| Cryptochironomus        | 1   | 4  |    |
| Dicrotendipes           |     | 13 | 1  |
| Endochironomus          | 1   | 2  |    |
| Forcipomyiinae          | 2   |    |    |
| Glyptotendipes          | 14  | 12 | 43 |
| Hemerodromia            | 3   |    |    |
| Hexatoma                | -99 |    |    |
| Kiefferulus             | 2   | 3  |    |
| Labrundinia             |     | 4  | 3  |
| Micropsectra            | 1   |    |    |
| Microtendipes           | 1   | 9  | 19 |
| Nanocladius             | 3   |    | 2  |
| Nilotanypus             | 14  |    |    |
| Parachironomus          | 2   | 20 | 26 |
| Parametrioctenemus      | 1   |    |    |
| Paratanytarsus          | 2   | 13 | 12 |

Aquid Invertebrate Database Bench Sheet Report

Dardenne Cr [14920], Station #6.1, Sample Date: 9/29/2014 2:20:00 PM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

| ORDER: TAXA                | CS  | NF  | RM  |
|----------------------------|-----|-----|-----|
| Paratendipes               | 1   | 15  | 1   |
| Pentaneura                 | 2   |     |     |
| Polypedilum flavum         | 285 |     |     |
| Polypedilum halterale grp  |     | 1   |     |
| Polypedilum illinoense grp | 55  | 9   | 2   |
| Polypedilum scalaenum grp  | 9   | 3   |     |
| Procladius                 |     | 1   |     |
| Psychoda                   | 1   |     |     |
| Rheocricotopus             | 3   |     |     |
| Rheotanytarsus             | 9   |     |     |
| Simulium                   | 6   |     |     |
| Stempellinella             | 6   | 3   | 7   |
| Stenochironomus            |     | 1   |     |
| Stictochironomus           | 1   | 2   |     |
| Tanytarsus                 | 33  | 32  | 21  |
| Thienemanniella            | 7   |     |     |
| Thienemannimyia grp.       | 25  |     | 3   |
| Tribelos                   |     |     | 1   |
| EPHEMEROPTERA              |     |     |     |
| Acerpenna                  | 2   |     |     |
| Baetis                     | 50  | 1   |     |
| Caenis latipennis          | 23  | 110 | 94  |
| Callibaetis                | 1   |     |     |
| Stenacron                  | 2   | 2   |     |
| Stenonema femoratum        | 20  | 28  | 3   |
| HEMIPTERA                  |     |     |     |
| Belostoma                  |     |     | -99 |
| ISOPODA                    |     |     |     |
| Lirceus                    | 3   | 3   | 1   |
| ODONATA                    |     |     |     |
| Argia                      |     |     | 3   |
| Calopteryx                 |     |     | 3   |
| Enallagma                  |     | 6   | 21  |
| Erythemis                  |     |     | 1   |
| Hetaerina                  |     |     | 1   |
| Ischnura                   |     |     | 3   |
| Somatochlora               |     |     | 1   |
| PLECOPTERA                 |     |     |     |

Aquid Invertebrate Database Bench Sheet Report

Dardenne Cr [14920], Station #6.1, Sample Date: 9/29/2014 2:20:00 PM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

| ORDER: TAXA              | CS | NF | RM |
|--------------------------|----|----|----|
| Perlidae                 | 4  |    |    |
| TRICHOPTERA              |    |    |    |
| Cheumatopsyche           | 94 |    | 1  |
| Chimarra                 | 8  |    | 1  |
| Oecetis                  |    | 1  | 2  |
| Triaenodes               |    | 3  | 6  |
| TRICLADIDA               |    |    |    |
| Planariidae              | 1  | 1  | 2  |
| TUBIFICIDA               |    |    |    |
| Limnodrilus hoffmeisteri |    | 1  |    |
| Tubificidae              | 2  | 9  |    |
| VENEROIDA                |    |    |    |
| Pisidiidae               |    | 1  |    |

**Spring 2015 Data**

Aquid Invertebrate Database Bench Sheet Report

Dardenne Cr [15013], Station #1, Sample Date: 3/30/2015 1:05:00 PM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

| ORDER: TAXA             | CS  | NF | RM  |
|-------------------------|-----|----|-----|
| "HYDRACARINA"           |     |    |     |
| Acarina                 | 1   | 5  | 3   |
| AMPHIPODA               |     |    |     |
| Crangonyx               |     | 2  | 4   |
| Gammarus                |     |    | -99 |
| ARHYNCHOBDELLIDA        |     |    |     |
| Erpobdellidae           | -99 |    |     |
| BASOMMATOPHORA          |     |    |     |
| Helisoma                | -99 |    |     |
| COLEOPTERA              |     |    |     |
| Berosus                 |     | 2  | 3   |
| Dubiraphia              |     | 1  |     |
| Stenelmis               | 3   | 1  |     |
| DIPTERA                 |     |    |     |
| Ablabesmyia             |     | 14 | 2   |
| Ceratopogoninae         | 3   | 2  |     |
| Chironomidae            | 6   | 5  | 2   |
| Cladotanytarsus         | 12  | 16 |     |
| Corynoneura             | 3   | 4  | 9   |
| Cricotopus bicinctus    | 7   | 4  | 12  |
| Cricotopus/Orthocladius | 184 | 28 | 84  |

Aquid Invertebrate Database Bench Sheet Report

Dardenne Cr [15013], Station #1, Sample Date: 3/30/2015 1:05:00 PM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

| ORDER: TAXA                   | CS  | NF  | RM |
|-------------------------------|-----|-----|----|
| Cryptochironomus              | 3   | 2   | 1  |
| Dicrotendipes                 | 2   | 5   | 1  |
| Diptera                       |     | 1   |    |
| Eukiefferiella                | 1   |     |    |
| Hydrobaenus                   | 106 | 100 | 23 |
| Labrundinia                   |     | 1   | 2  |
| Microtendipes                 | 2   |     |    |
| Nanocladius                   |     |     | 1  |
| Natarsia                      | 1   |     |    |
| Nilotanytus                   | 1   |     |    |
| Orthocladius (Euorthocladius) | 26  | 1   | 9  |
| Paracladopelma                |     | 4   |    |
| Parametriocnemus              | 4   |     |    |
| Paratanytarsus                | 5   | 5   | 18 |
| Paratendipes                  | 2   | 12  |    |
| Polypedilum aviceps           | 3   |     | 1  |
| Polypedilum flavum            | 55  | 2   | 10 |
| Polypedilum halterale grp     | 16  | 20  |    |
| Polypedilum illinoense grp    |     | 2   | 5  |
| Polypedilum scalaenum grp     | 24  | 27  | 1  |
| Prosimulium                   | 9   |     | 16 |
| Rheotanytarsus                | 7   |     | 4  |
| Saetheria                     | 1   |     |    |
| Simulium                      | 2   |     |    |
| Stempellinella                |     | 2   |    |
| Stictochironomus              | 11  | 34  |    |
| Sympotthastia                 | 1   | 1   |    |
| Tanytarsus                    | 44  | 23  | 33 |
| Thienemanniella               | 1   |     | 5  |
| Thienemannimyia grp.          | 9   | 1   | 7  |
| Tipula                        | -99 |     |    |
| EPHEMEROPTERA                 |     |     |    |
| Acerpenna                     | 16  | 1   | 24 |
| Caenis latipennis             |     | 14  | 15 |
| Stenacron                     | 1   |     |    |
| Stenonema femoratum           | 7   | 6   | 2  |
| ISOPODA                       |     |     |    |
| Caecidotea                    | 1   |     | 3  |
| ODONATA                       |     |     |    |
| Argia                         |     | 1   | 1  |
| Calopteryx                    |     |     | 1  |
| Enallagma                     |     | 3   | 2  |
| Epithea (Epicordulia)         |     | 1   |    |
| Epithea (Tetragoneuria)       |     | -99 |    |

Aquid Invertebrate Database Bench Sheet Report

Dardenne Cr [15013], Station #1, Sample Date: 3/30/2015 1:05:00 PM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

| ORDER: TAXA               | CS  | NF  | RM |
|---------------------------|-----|-----|----|
| Neurocordulia             |     | -99 |    |
| Progomphus obscurus       |     | 1   |    |
| PLECOPTERA                |     |     |    |
| Isoperla                  | 3   |     |    |
| Perlesta                  | 2   |     | 3  |
| TRICHOPTERA               |     |     |    |
| Cheumatopsyche            | 3   |     |    |
| Pycnopsyche               |     |     | 1  |
| TUBIFICIDA                |     |     |    |
| Branchiura sowerbyi       | -99 |     |    |
| Enchytraeidae             | 4   | 1   |    |
| Limnodrilus claparedianus | 2   |     |    |
| Limnodrilus hoffmeisteri  | 7   | 4   |    |
| Limnodrilus udekemianus   |     | 1   |    |
| Tubificidae               | 5   | 13  |    |
| VENEROIDA                 |     |     |    |
| Pisidiidae                | 2   |     |    |

Aquid Invertebrate Database Bench Sheet Report

Dardenne Cr [15005], Station #2, Sample Date: 3/24/2015 10:40:00 AM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

| ORDER: TAXA             | CS  | NF  | RM |
|-------------------------|-----|-----|----|
| "HYDRACARINA"           |     |     |    |
| Acarina                 | 3   |     | 10 |
| AMPHIPODA               |     |     |    |
| Hyalella azteca         |     |     | 1  |
| BASOMMATOPHORA          |     |     |    |
| Helisoma                |     | -99 |    |
| COLEOPTERA              |     |     |    |
| Berosus                 | 1   |     | 6  |
| Dubiraphia              |     |     | 6  |
| Helichus lithophilus    |     |     | 1  |
| Stenelmis               | 7   |     |    |
| DIPTERA                 |     |     |    |
| Ablabesmyia             |     | 5   | 14 |
| Ceratopogoninae         | 18  |     | 3  |
| Chironomidae            | 4   |     |    |
| Cladotanytarsus         | 6   | 7   |    |
| Corynoneura             | 13  | 1   | 20 |
| Cricotopus bicinctus    | 1   |     | 8  |
| Cricotopus/Orthocladius | 240 | 20  | 33 |
| Cryptochironomus        | 2   | 6   |    |
| Dicrotendipes           | 2   | 2   | 2  |
| Eukiefferiella          | 2   |     |    |

Aquid Invertebrate Database Bench Sheet Report

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CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

| ORDER: TAXA                      | CS  | NF  | RM  |
|----------------------------------|-----|-----|-----|
| Gonomyia                         |     | 1   |     |
| Hemerodromia                     | 3   |     |     |
| Hexatoma                         | -99 |     |     |
| Hydrobaenus                      | 35  | 183 | 4   |
| Labrundinia                      |     |     | 10  |
| Nanocladius                      |     |     | 26  |
| Nilotanytus                      | 4   | 1   |     |
| Orthocladius (Euorthocladius)    | 42  |     |     |
| Paracladopelma                   |     | 1   |     |
| Parakiefferiella                 | 6   |     | 1   |
| Parametriocnemus                 | 10  | 1   |     |
| Paratanytarsus                   | 2   | 1   | 81  |
| Paratendipes                     | 1   | 4   | 2   |
| Phaenopsectra                    |     | 1   |     |
| Polypedilum aviceps              | 3   |     |     |
| Polypedilum flavum               | 79  |     | 2   |
| Polypedilum halterale grp        | 1   |     |     |
| Polypedilum illinoense grp       | 4   |     | 4   |
| Polypedilum scalaenum grp        | 22  | 13  |     |
| Pseudochironomus                 |     | 1   |     |
| Rheocricotopus                   | 3   |     |     |
| Rheotanytarsus                   | 13  | 1   | 4   |
| Saetheria                        | 2   |     |     |
| Simulium                         | 14  |     |     |
| Stempellinella                   | 2   |     | 1   |
| Stenochironomus                  |     |     | 1   |
| Stictochironomus                 |     | 3   |     |
| Sympothastia                     | 6   | 1   |     |
| Tanytarsus                       | 27  | 22  | 62  |
| Thienemanniella                  | 29  |     | 5   |
| Thienemannimyia grp.             | 3   | 4   | 9   |
| Tvetenia bavarica grp            | 4   |     |     |
| EPHEMEROPTERA                    |     |     |     |
| Acerpenna                        | 37  |     | 3   |
| Caenis latipennis                | 4   | 1   | 13  |
| Centroptilum                     |     |     | 1   |
| Stenonema femoratum              | 3   | 6   | -99 |
| ISOPODA                          |     |     |     |
| Caecidotea                       |     | 4   |     |
| Caecidotea (Blind & Unpigmented) |     |     | 1   |
| ODONATA                          |     |     |     |
| Enallagma                        |     |     | 12  |
| Somatochlora                     |     |     | 1   |
| PLECOPTERA                       |     |     |     |

Aquid Invertebrate Database Bench Sheet Report

Dardenne Cr [15005], Station #2, Sample Date: 3/24/2015 10:40:00 AM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

| ORDER: TAXA              | CS  | NF | RM  |
|--------------------------|-----|----|-----|
| Alloperla                | 1   |    |     |
| Perlesta                 | 3   |    |     |
| Perlodidae               | 2   |    |     |
| Zealeuctra               | 1   |    |     |
| TRICHOPTERA              |     |    |     |
| Cheumatopsyche           | 8   |    | 1   |
| Hydroptila               |     |    | 1   |
| Polycentropus            |     |    | 1   |
| Pycnopsyche              |     |    | -99 |
| Triaenodes               |     |    | 2   |
| TRICLADIDA               |     |    |     |
| Planariidae              |     |    | 1   |
| TUBIFICIDA               |     |    |     |
| Enchytraeidae            |     | 6  |     |
| Limnodrilus hoffmeisteri |     | 2  |     |
| Tubificidae              | 4   | 22 | 3   |
| VENEROIDA                |     |    |     |
| Corbicula                | 1   |    |     |
| Pisidiidae               | -99 |    |     |

Aquid Invertebrate Database Bench Sheet Report

Dardenne Cr [15008], Station #3, Sample Date: 3/24/2015 4:10:00 PM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

| ORDER: TAXA             | CS  | NF | RM |
|-------------------------|-----|----|----|
| "HYDRACARINA"           |     |    |    |
| Acarina                 | 2   | 1  | 1  |
| AMPHIPODA               |     |    |    |
| Crangonyx               |     | 1  |    |
| ARHYNCHOBDELLIDA        |     |    |    |
| Erpobdellidae           | -99 |    |    |
| COLEOPTERA              |     |    |    |
| Berosus                 | 1   |    |    |
| Stenelmis               | 13  |    |    |
| DIPTERA                 |     |    |    |
| Ablabesmyia             | 1   | 16 | 4  |
| Ceratopogoninae         | 5   | 7  |    |
| Chironomidae            | 4   | 3  | 2  |
| Cladotanytarsus         | 4   | 11 | 2  |
| Clinocera               | 3   | 1  |    |
| Corynoneura             | 16  | 10 | 17 |
| Cricotopus bicinctus    | 3   |    | 8  |
| Cricotopus/Orthocladius | 139 | 7  | 34 |
| Cryptochironomus        |     | 7  |    |
| Diamesa                 | 2   |    |    |



Aquid Invertebrate Database Bench Sheet Report

Dardenne Cr [15008], Station #3, Sample Date: 3/24/2015 4:10:00 PM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

| ORDER: TAXA                   | CS  | NF  | RM  |
|-------------------------------|-----|-----|-----|
| Dicrotendipes                 | 1   | 9   | 1   |
| Diptera                       |     | 1   |     |
| Eukiefferiella                | 3   |     |     |
| Hemerodromia                  | 2   |     |     |
| Hexatoma                      | -99 |     |     |
| Hydrobaenus                   | 69  | 86  | 26  |
| Labrundinia                   |     | 2   | 1   |
| Microtendipes                 |     | 1   |     |
| Nanocladius                   |     |     | 4   |
| Orthocladius (Euorthocladius) | 68  | 1   | 34  |
| Parakiefferiella              | 6   |     |     |
| Parametriocnemus              | 5   |     | 2   |
| Paratanytarsus                | 3   | 7   | 23  |
| Paratendipes                  | 1   | 7   |     |
| Phaenopsectra                 |     |     | 1   |
| Polypedilum aviceps           | 3   |     |     |
| Polypedilum flavum            | 83  | 2   | 5   |
| Polypedilum halterale grp     |     | 3   |     |
| Polypedilum illinoense grp    | 2   |     | 2   |
| Polypedilum scalaenum grp     | 28  | 47  | 2   |
| Pseudochironomus              |     | 1   |     |
| Rheocricotopus                | 3   |     |     |
| Rheotanytarsus                | 3   |     | 14  |
| Simulium                      | 12  |     | 18  |
| Stempellinella                |     | 17  | 2   |
| Stictochironomus              |     | 23  |     |
| Sympotthastia                 | 4   |     | 2   |
| Tabanus                       | -99 |     |     |
| Tanytarsus                    | 31  | 27  | 19  |
| Thienemanniella               | 7   | 2   | 23  |
| Thienemannimyia grp.          | 16  | 3   | 2   |
| Tvetenia bavarica grp         | 3   |     |     |
| EPHEMEROPTERA                 |     |     |     |
| Acerpenna                     | 30  |     | 27  |
| Caenis latipennis             | 2   | 7   | 6   |
| Stenonema femoratum           | 5   | 4   | 1   |
| ISOPODA                       |     |     |     |
| Caecidotea                    | 2   | 1   | 1   |
| ODONATA                       |     |     |     |
| Basiaeschna janata            |     |     | -99 |
| Progomphus obscurus           |     | -99 |     |
| PLECOPTERA                    |     |     |     |
| Amphinemura                   | 2   |     |     |
| Hydroperla crosbyi            | -99 |     | 1   |

Aquid Invertebrate Database Bench Sheet Report

Dardenne Cr [15008], Station #3, Sample Date: 3/24/2015 4:10:00 PM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

| ORDER: TAXA     | CS | NF  | RM |
|-----------------|----|-----|----|
| Perlidae        | 9  |     |    |
| Perlodidae      | 3  |     |    |
| RHYNCHOBDELLIDA |    |     |    |
| Glossiphoniidae |    | -99 |    |
| TRICHOPTERA     |    |     |    |
| Cheumatopsyche  | 13 |     | 10 |
| Chimarra        | 1  |     |    |
| Hydroptila      | 1  |     |    |
| TUBIFICIDA      |    |     |    |
| Aulodrilus      |    | 2   |    |
| Enchytraeidae   | 2  |     |    |
| Tubificidae     | 1  | 5   |    |
| VENEROIDA       |    |     |    |
| Corbicula       |    | -99 |    |
| Pisidiidae      |    | 2   |    |

Aquid Invertebrate Database Bench Sheet Report

Dardenne Cr [15011], Station #4, Sample Date: 3/30/2015 10:45:00 AM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

| ORDER: TAXA               | CS  | NF  | RM |
|---------------------------|-----|-----|----|
| "HYDRACARINA"             |     |     |    |
| Acarina                   | 1   |     | 1  |
| AMPHIPODA                 |     |     |    |
| Hyaella azteca            |     |     | 2  |
| COLEOPTERA                |     |     |    |
| Dubiraphia                |     | 1   | 1  |
| Stenelmis                 | 2   |     |    |
| DIPTERA                   |     |     |    |
| Ablabesmyia               |     | 12  | 8  |
| Ceratopogoninae           | 1   | 3   |    |
| Chironomidae              | 1   | 2   |    |
| Cladotanytarsus           | 9   | 5   |    |
| Clinocera                 | 2   |     | 1  |
| Corynoneura               | 8   |     | 33 |
| Cricotopus sylvestris grp | 6   | 6   | 4  |
| Cricotopus/Orthocladius   | 142 | 6   | 67 |
| Cryptochironomus          | 2   | 2   |    |
| Demicryptochironomus      | 2   |     |    |
| Dicrotendipes             | 1   | 4   | 2  |
| Eukiefferiella            | 2   |     |    |
| Eukiefferiella brehmi grp |     |     | 1  |
| Forcipomyiinae            |     |     | 1  |
| Glyptotendipes            |     |     | 1  |
| Hydrobaenus               | 174 | 197 | 26 |

Aquid Invertebrate Database Bench Sheet Report

Dardenne Cr [15011], Station #4, Sample Date: 3/30/2015 10:45:00 AM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

| ORDER: TAXA                   | CS | NF  | RM  |
|-------------------------------|----|-----|-----|
| Labrundinia                   |    |     | 2   |
| Microtendipes                 | 1  | 1   |     |
| Nilotanypus                   | 1  |     | 2   |
| Orthocladius (Euorthocladius) | 59 | 1   | 14  |
| Paracladopelma                | 6  |     |     |
| Paralauterborniella           |    | 1   |     |
| Parametriocnemus              | 1  | 1   |     |
| Paratanytarsus                |    | 2   | 14  |
| Paratendipes                  |    | 8   | 1   |
| Phaenopsectra                 | 1  | 1   |     |
| Polypedilum aviceps           |    |     | 2   |
| Polypedilum fallax grp        |    | 1   |     |
| Polypedilum flavum            | 97 | 3   | 3   |
| Polypedilum halterale grp     | 6  | 3   |     |
| Polypedilum illinoense grp    |    | 1   | 7   |
| Polypedilum scalaenum grp     | 19 | 8   |     |
| Prosimulium                   | 4  |     |     |
| Rheocricotopus                | 3  |     | 1   |
| Rheotanytarsus                | 2  |     | 3   |
| Simulium                      | 8  |     | 1   |
| Stempellinella                | 1  | 2   | 2   |
| Stictochironomus              | 3  | 34  |     |
| Tanytarsus                    | 20 | 17  | 35  |
| Thienemanniella               | 4  |     | 7   |
| Thienemannimyia grp.          | 9  | 3   | 10  |
| Zavreliomyia                  | 2  |     |     |
| EPHEMEROPTERA                 |    |     |     |
| Acerpenna                     | 7  |     | 21  |
| Caenis latipennis             |    | 2   | 8   |
| Centroptilum                  |    |     | 1   |
| Leptophlebiidae               |    |     | 1   |
| Stenonema femoratum           | 5  | 3   | 6   |
| ISOPODA                       |    |     |     |
| Caecidotea                    |    | 1   |     |
| ODONATA                       |    |     |     |
| Basiaeschna janata            |    | -99 |     |
| Calopteryx                    |    |     | 1   |
| Enallagma                     |    |     | 2   |
| Progomphus obscurus           |    | -99 |     |
| PLECOPTERA                    |    |     |     |
| Allocapnia                    | 1  |     |     |
| Amphinemura                   | 3  |     |     |
| Chloroperlidae                | 3  |     |     |
| Clioperla clio                |    |     | -99 |

Aquid Invertebrate Database Bench Sheet Report

Dardenne Cr [15011], Station #4, Sample Date: 3/30/2015 10:45:00 AM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

| ORDER: TAXA              | CS  | NF  | RM |
|--------------------------|-----|-----|----|
| Hydroperla crosbyi       | -99 |     |    |
| Isoperla                 | 2   |     | 1  |
| Perlesta                 | 3   |     | 1  |
| RHYNCHOBDELLIDA          |     |     |    |
| Glossiphoniidae          |     | -99 |    |
| TRICHOPTERA              |     |     |    |
| Cheumatopsyche           | -99 |     | 3  |
| Chimarra                 | 2   |     |    |
| Hydroptila               |     |     | 1  |
| Triaenodes               |     | 1   |    |
| TUBIFICIDA               |     |     |    |
| Enchytraeidae            | 2   |     |    |
| Limnodrilus hoffmeisteri | 2   | 5   |    |
| Tubificidae              | 1   | 7   |    |

Aquid Invertebrate Database Bench Sheet Report

Dardenne Cr [15012], Station #4.1, Sample Date: 3/30/2015 11:05:00 AM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

| ORDER: TAXA             | CS  | NF | RM  |
|-------------------------|-----|----|-----|
| "HYDRACARINA"           |     |    |     |
| Acarina                 |     | 8  | 3   |
| AMPHIPODA               |     |    |     |
| Hyaella azteca          |     |    | 2   |
| BASOMMATOPHORA          |     |    |     |
| Ancylidae               | 1   |    | 2   |
| Physella                | 1   |    |     |
| COLEOPTERA              |     |    |     |
| Berosus                 | -99 |    |     |
| Dubiraphia              |     |    | 1   |
| Peltodytes              |     | 1  |     |
| Stenelmis               | 5   | 3  |     |
| DECAPODA                |     |    |     |
| Orconectes virilis      |     |    | -99 |
| DIPTERA                 |     |    |     |
| Ablabesmyia             |     | 7  | 3   |
| Axarus                  |     | 1  |     |
| Ceratopogoninae         | 4   | 7  | 2   |
| Chironomidae            | 4   |    | 1   |
| Cladotanytarsus         | 5   | 5  | 2   |
| Clinocera               | 5   |    |     |
| Corynoneura             | 3   | 4  | 27  |
| Cricotopus bicinctus    | 2   |    | 7   |
| Cricotopus/Orthocladius | 151 | 12 | 133 |
| Cryptochironomus        | 2   | 6  | 4   |

Aquid Invertebrate Database Bench Sheet Report

Dardenne Cr [15012], Station #4.1, Sample Date: 3/30/2015 11:05:00 AM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

| ORDER: TAXA                   | CS  | NF  | RM  |
|-------------------------------|-----|-----|-----|
| Demicryptochironomus          | 1   | 1   |     |
| Diamesa                       | 2   |     |     |
| Dicrotendipes                 | 4   | 13  | 10  |
| Eukiefferiella                | 2   |     |     |
| Hemerodromia                  | 6   |     |     |
| Hexatoma                      | 1   | 2   |     |
| Hydrobaenus                   | 98  | 181 | 143 |
| Labrundinia                   |     |     | 2   |
| Larsia                        |     |     | 1   |
| Microtendipes                 |     | 1   | 3   |
| Nanocladius                   |     | 1   | 2   |
| Nilotanytus                   | 1   |     |     |
| Orthocladius (Euorthocladius) | 62  | 4   | 19  |
| Paracladopelma                |     | 2   | 2   |
| Parametriocnemus              | 7   |     | 1   |
| Paraphaenocladius             | 1   |     | 1   |
| Paratanytarsus                |     | 3   | 37  |
| Paratendipes                  | 1   | 6   | 3   |
| Phaenopsectra                 |     |     | 2   |
| Polypedilum aviceps           | 2   |     |     |
| Polypedilum flavum            | 133 | 2   | 8   |
| Polypedilum illinoense grp    |     | 1   | 1   |
| Polypedilum scalaenum grp     | 10  | 11  | 2   |
| Prosimulium                   | 2   |     |     |
| Pseudochironomus              | 1   | 1   |     |
| Pseudosmittia                 |     |     | 1   |
| Rheocricotopus                | 3   |     | 1   |
| Rheotanytarsus                | 7   |     | 11  |
| Simulium                      | 16  |     | 2   |
| Stempellinella                | 3   | 3   | 15  |
| Stictochironomus              |     | 20  | 1   |
| Sympotthastia                 |     |     | 2   |
| Tabanus                       | -99 |     |     |
| Tanytarsus                    | 32  | 11  | 105 |
| Thienemanniella               | 5   | 2   | 3   |
| Thienemannimyia grp.          | 8   | 6   | 15  |
| Tvetenia bavarica grp         | 4   |     | 1   |
| EPHEMEROPTERA                 |     |     |     |
| Acerpenna                     | 7   |     | 4   |
| Caenis latipennis             | 3   | 3   | 17  |
| Centroptilum                  |     |     | 5   |
| Dipheter                      | 1   |     |     |
| Stenonema femoratum           | 9   | 9   | 2   |
| Tricorythodes                 | 1   |     |     |

Aquid Invertebrate Database Bench Sheet Report

Dardenne Cr [15012], Station #4.1, Sample Date: 3/30/2015 11:05:00 AM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

| ORDER: TAXA               | CS  | NF  | RM  |
|---------------------------|-----|-----|-----|
| HEMIPTERA                 |     |     |     |
| Microvelia                |     |     | 1   |
| ISOPODA                   |     |     |     |
| Caecidotea                |     |     | 1   |
| ODONATA                   |     |     |     |
| Argia                     |     | -99 | 1   |
| Enallagma                 |     |     | 1   |
| Progomphus obscurus       | -99 | 1   |     |
| PLECOPTERA                |     |     |     |
| Amphinemura               | 2   |     |     |
| Chloroperlidae            | 1   |     |     |
| Clioperla clio            | -99 |     | -99 |
| Isoperla                  | 2   |     |     |
| Perlesta                  | 9   |     |     |
| TRICHOPTERA               |     |     |     |
| Cheumatopsyche            | 12  | 1   | 1   |
| Chimarra                  | 5   |     |     |
| Hydropsyche               | -99 |     |     |
| Hydroptila                |     |     | 1   |
| Pycnopsyche               |     |     | 1   |
| Triaenodes                |     |     | 1   |
| TUBIFICIDA                |     |     |     |
| Enchytraeidae             | 5   | 3   |     |
| Limnodrilus claparedianus |     | 1   |     |
| Tubificidae               |     | 5   |     |
| VENEROIDA                 |     |     |     |
| Pisidiidae                |     | 1   |     |

Aquid Invertebrate Database Bench Sheet Report

Dardenne Cr [15006], Station #4.9, Sample Date: 3/24/2015 1:20:00 PM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

| ORDER: TAXA      | CS | NF | RM  |
|------------------|----|----|-----|
| "HYDRACARINA"    |    |    |     |
| Acarina          | 2  |    | 2   |
| BASOMMATOPHORA   |    |    |     |
| Physella         |    |    | 1   |
| BRANCHIOBDELLIDA |    |    |     |
| Branchiobdellida |    | 1  |     |
| COLEOPTERA       |    |    |     |
| Dubiraphia       |    | 1  | 4   |
| Peltodytes       |    |    | 1   |
| Stenelmis        | 8  | 1  |     |
| Tropisternus     |    |    | -99 |
| DECAPODA         |    |    |     |

Aquid Invertebrate Database Bench Sheet Report

Dardenne Cr [15006], Station #4.9, Sample Date: 3/24/2015 1:20:00 PM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

| ORDER: TAXA                   | CS  | NF  | RM  |
|-------------------------------|-----|-----|-----|
| Orconectes virilis            |     |     | -99 |
| DIPTERA                       |     |     |     |
| Ablabesmyia                   |     | 4   | 10  |
| Ceratopogoninae               | 5   | 1   | 3   |
| Chrysops                      |     | 1   |     |
| Cladotanytarsus               | 4   | 6   |     |
| Clinocera                     | 2   | 1   |     |
| Corynoneura                   | 18  | 1   | 39  |
| Cricotopus bicinctus          | 5   |     | 2   |
| Cricotopus/Orthocladius       | 214 | 11  | 27  |
| Cryptochironomus              | 2   | 3   | 1   |
| Demicryptochironomus          | 1   |     |     |
| Diamesa                       | 1   |     | 1   |
| Dicrotendipes                 | 2   | 5   | 1   |
| Eukiefferiella                | 1   |     |     |
| Glyptotendipes                |     |     | 2   |
| Hemerodromia                  | 3   |     |     |
| Hydrobaenus                   | 66  | 123 | 35  |
| Labrundinia                   |     |     | 1   |
| Nanocladius                   |     |     | 10  |
| Nilotanypus                   | 5   | 1   |     |
| Orthocladius (Euorthocladius) | 94  |     | 3   |
| Parachironomus                |     |     | 1   |
| Paracladopelma                |     | 1   |     |
| Parametriocnemus              | 3   |     |     |
| Paraphaenocladius             |     |     | 1   |
| Paratanytarsus                |     | 1   | 24  |
| Paratendipes                  | 2   | 35  | 5   |
| Phaenopsectra                 |     |     | 3   |
| Polypedilum fallax grp        |     |     | 1   |
| Polypedilum flavum            | 88  | 1   | 7   |
| Polypedilum illinoense grp    | 2   |     | 9   |
| Polypedilum scalaenum grp     | 37  | 16  | 3   |
| Prosimulium                   | 1   |     |     |
| Pseudochironomus              |     | 1   |     |
| Rheocricotopus                | 4   |     | 1   |
| Rheotanytarsus                | 8   |     | 5   |
| Simulium                      | 2   |     |     |
| Stempellinella                | 8   | 1   | 14  |
| Stenochironomus               |     |     | 1   |
| Stictochironomus              |     | 10  |     |
| Tabanus                       | 1   |     |     |
| Tanytarsus                    | 29  | 14  | 54  |
| Thienemanniella               | 11  | 5   | 2   |

Aquid Invertebrate Database Bench Sheet Report

Dardenne Cr [15006], Station #4.9, Sample Date: 3/24/2015 1:20:00 PM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

| ORDER: TAXA           | CS  | NF | RM  |
|-----------------------|-----|----|-----|
| Thienemannimyia grp.  | 4   | 1  | 10  |
| Tokunagaia            | 1   |    |     |
| Tvetenia bavarica grp | 1   |    |     |
| Zavreliomyia          |     |    | 1   |
| EPHEMEROPTERA         |     |    |     |
| Acerpenna             | 7   |    |     |
| Caenis latipennis     | 2   | 7  | 33  |
| Centropilum           |     |    | 3   |
| Dipheter              | 4   |    |     |
| Stenacron             |     |    | 1   |
| Stenonema femoratum   | 3   | 3  | 2   |
| ISOPODA               |     |    |     |
| Caecidotea            | -99 | 1  | 1   |
| ODONATA               |     |    |     |
| Argia                 |     |    | 2   |
| Calopteryx            |     |    | -99 |
| Enallagma             |     |    | 4   |
| Somatochlora          |     |    | 1   |
| PLECOPTERA            |     |    |     |
| Clioperla clio        |     |    | 1   |
| Leuctridae            | 1   |    |     |
| Perlidae              | 7   |    |     |
| Perlodidae            | 1   |    |     |
| TRICHOPTERA           |     |    |     |
| Cheumatopsyche        | 5   |    | 1   |
| Chimarra              | 1   |    |     |
| Hydropsyche           | 1   |    |     |
| Pycnopsyche           |     |    | -99 |
| Triaenodes            |     |    | 1   |
| TRICLADIDA            |     |    |     |
| Planariidae           |     |    | 1   |
| TUBIFICIDA            |     |    |     |
| Enchytraeidae         |     | 1  |     |
| Tubificidae           |     | 4  | 3   |

Aquid Invertebrate Database Bench Sheet Report

Dardenne Cr [15007], Station #6.1, Sample Date: 3/24/2015 2:45:00 PM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

| ORDER: TAXA      | CS | NF | RM |
|------------------|----|----|----|
| "HYDRACARINA"    |    |    |    |
| Acarina          | 2  |    | 1  |
| AMPHIPODA        |    |    |    |
| Hyaella azteca   |    |    | 12 |
| ARHYNCHOBDELLIDA |    |    |    |



Aquid Invertebrate Database Bench Sheet Report

Dardenne Cr [15007], Station #6.1, Sample Date: 3/24/2015 2:45:00 PM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

| ORDER: TAXA                   | CS  | NF  | RM  |
|-------------------------------|-----|-----|-----|
| Erpobdellidae                 | -99 |     |     |
| BASOMMATOPHORA                |     |     |     |
| Menetus                       |     |     | 1   |
| Physella                      | -99 |     |     |
| BRANCHIOBDELLIDA              |     |     |     |
| Branchiobdellida              |     |     | 1   |
| COLEOPTERA                    |     |     |     |
| Dubiraphia                    |     |     | 2   |
| Helichus basalis              |     |     | -99 |
| Stenelmis                     | 23  | 2   | 1   |
| DECAPODA                      |     |     |     |
| Orconectes virilis            |     |     | -99 |
| DIPTERA                       |     |     |     |
| Ablabesmyia                   |     | 4   |     |
| Ceratopogoninae               | 5   | 4   | 1   |
| Chironomidae                  | 3   | 1   |     |
| Cladotanytarsus               | 2   | 8   |     |
| Clinocera                     | 1   |     |     |
| Corynoneura                   | 51  | 3   | 65  |
| Cricotopus bicinctus          | 5   |     | 3   |
| Cricotopus/Orthocladius       | 122 | 7   | 14  |
| Cryptochironomus              | 4   | 14  |     |
| Diamesa                       | 2   |     |     |
| Eukiefferiella                | 2   |     |     |
| Glyptotendipes                |     | 1   | 2   |
| Hemerodromia                  | 5   |     |     |
| Hexatoma                      | 2   |     |     |
| Hydrobaenus                   | 98  | 149 | 6   |
| Labrundinia                   |     |     | 2   |
| Microtendipes                 | 2   | 1   |     |
| Nanocladius                   | 1   | 1   | 12  |
| Orthocladius (Euorthocladius) | 43  |     |     |
| Parachironomus                | 1   |     |     |
| Paracladopelma                |     | 1   |     |
| Parametriocnemus              | 5   |     |     |
| Paraphaenocladius             |     | 1   |     |
| Paratanytarsus                |     |     | 10  |
| Paratendipes                  | 2   | 6   | 1   |
| Pilaria                       |     | -99 |     |
| Polypedilum aviceps           | 5   |     | 1   |
| Polypedilum flavum            | 120 |     | 8   |
| Polypedilum illinoense grp    | 2   | 1   |     |
| Polypedilum scalaenum grp     | 38  | 37  | 1   |
| Rheocricotopus                | 1   |     |     |

Aquid Invertebrate Database Bench Sheet Report

Dardenne Cr [15007], Station #6.1, Sample Date: 3/24/2015 2:45:00 PM

CS = Coarse; NF = Nonflow; RM = Rootmat; -99 = Presence

| ORDER: TAXA               | CS  | NF  | RM  |
|---------------------------|-----|-----|-----|
| Rheotanytarsus            | 1   |     | 3   |
| Simulium                  | 2   |     |     |
| Stempellinella            | 1   | 8   | 14  |
| Stictochironomus          |     | 13  |     |
| Tanytarsus                | 10  | 17  | 34  |
| Thienemanniella           | 36  | 1   | 22  |
| Thienemannimyia grp.      | 11  | 1   | 6   |
| Tipula                    | -99 |     |     |
| Tvetenia bavarica grp     | 6   |     |     |
| Zavreliomyia              |     | 1   | 13  |
| EPHEMEROPTERA             |     |     |     |
| Acerpenna                 | 4   |     | 1   |
| Caenis latipennis         | 5   | 15  | 36  |
| Centroptilum              |     |     | 1   |
| Stenacron                 |     | 1   |     |
| Stenonema femoratum       | 1   | 4   | -99 |
| ISOPODA                   |     |     |     |
| Caecidotea                | 3   | 1   | -99 |
| MEGALOPTERA               |     |     |     |
| Sialis                    |     | -99 |     |
| ODONATA                   |     |     |     |
| Argia                     |     |     | 2   |
| Calopteryx                |     |     | 4   |
| Hagenius brevistylus      |     |     | 1   |
| Somatochlora              |     |     | -99 |
| PLECOPTERA                |     |     |     |
| Allocapnia                | 1   |     |     |
| Amphinemura               | 5   |     |     |
| Clioperla clio            | 1   |     |     |
| Perlesta                  | 5   |     |     |
| Perlodidae                | 3   |     |     |
| TRICHOPTERA               |     |     |     |
| Cheumatopsyche            | 15  |     |     |
| Chimarra                  | 1   |     |     |
| Polycentropus             | 1   |     |     |
| Triaenodes                |     |     | 1   |
| TUBIFICIDA                |     |     |     |
| Enchytraeidae             |     | 17  |     |
| Limnodrilus claparedianus | 1   | 1   |     |
| Limnodrilus hoffmeisteri  |     | 2   | 1   |
| Tubificidae               | 2   | 22  |     |

## **Appendix B**

Multiparameter Data Sonde Collection:  
Dardenne Creek, St. Charles Co, MO  
August 8-14, 2014

**Dardenne Station 1 data sonde data:**

| Date M/D/Y          | Temp  | SpCond | DO   |                     |       |     |      |
|---------------------|-------|--------|------|---------------------|-------|-----|------|
| Time HH:MM:SS       | C     | uS     | mg/L |                     |       |     |      |
| 08/08/2014 14:15:31 | 23.55 | 289    | 7.11 | 08/09/2014 01:45:32 | 23.41 | 324 | 6.67 |
| 08/08/2014 14:30:31 | 23.56 | 290    | 7.10 | 08/09/2014 02:00:31 | 23.41 | 325 | 6.66 |
| 08/08/2014 14:45:31 | 23.57 | 291    | 7.09 | 08/09/2014 02:15:32 | 23.39 | 325 | 6.66 |
| 08/08/2014 15:00:31 | 23.58 | 292    | 7.08 | 08/09/2014 02:30:32 | 23.37 | 326 | 6.66 |
| 08/08/2014 15:15:31 | 23.61 | 292    | 7.06 | 08/09/2014 02:45:32 | 23.35 | 327 | 6.66 |
| 08/08/2014 15:30:32 | 23.64 | 293    | 7.06 | 08/09/2014 03:00:32 | 23.33 | 328 | 6.64 |
| 08/08/2014 15:45:31 | 23.68 | 294    | 7.08 | 08/09/2014 03:15:32 | 23.32 | 328 | 6.66 |
| 08/08/2014 16:00:31 | 23.70 | 295    | 7.07 | 08/09/2014 03:30:32 | 23.30 | 328 | 6.64 |
| 08/08/2014 16:15:31 | 23.71 | 296    | 7.06 | 08/09/2014 03:45:31 | 23.28 | 329 | 6.63 |
| 08/08/2014 16:30:31 | 23.72 | 297    | 7.06 | 08/09/2014 04:00:32 | 23.27 | 330 | 6.61 |
| 08/08/2014 16:45:31 | 23.71 | 298    | 7.05 | 08/09/2014 04:15:32 | 23.24 | 330 | 6.62 |
| 08/08/2014 17:00:31 | 23.71 | 298    | 7.03 | 08/09/2014 04:30:31 | 23.22 | 331 | 6.62 |
| 08/08/2014 17:15:31 | 23.72 | 299    | 7.03 | 08/09/2014 04:45:32 | 23.20 | 331 | 6.63 |
| 08/08/2014 17:30:31 | 23.73 | 300    | 7.00 | 08/09/2014 05:00:32 | 23.18 | 332 | 6.62 |
| 08/08/2014 17:45:31 | 23.74 | 301    | 6.98 | 08/09/2014 05:15:32 | 23.16 | 332 | 6.60 |
| 08/08/2014 18:00:31 | 23.74 | 302    | 6.98 | 08/09/2014 05:30:32 | 23.15 | 333 | 6.61 |
| 08/08/2014 18:15:31 | 23.75 | 302    | 6.95 | 08/09/2014 05:45:31 | 23.12 | 333 | 6.59 |
| 08/08/2014 18:30:31 | 23.75 | 303    | 6.95 | 08/09/2014 06:00:32 | 23.10 | 334 | 6.60 |
| 08/08/2014 18:45:32 | 23.75 | 304    | 6.93 | 08/09/2014 06:15:32 | 23.09 | 334 | 6.60 |
| 08/08/2014 19:00:32 | 23.74 | 305    | 6.91 | 08/09/2014 06:30:32 | 23.06 | 335 | 6.61 |
| 08/08/2014 19:15:32 | 23.74 | 306    | 6.90 | 08/09/2014 06:45:32 | 23.06 | 335 | 6.60 |
| 08/08/2014 19:30:32 | 23.74 | 307    | 6.89 | 08/09/2014 07:00:32 | 23.03 | 336 | 6.60 |
| 08/08/2014 19:45:31 | 23.72 | 308    | 6.87 | 08/09/2014 07:15:31 | 23.02 | 337 | 6.60 |
| 08/08/2014 20:00:31 | 23.72 | 308    | 6.86 | 08/09/2014 07:30:32 | 23.01 | 337 | 6.59 |
| 08/08/2014 20:15:32 | 23.71 | 309    | 6.84 | 08/09/2014 07:45:32 | 23.00 | 337 | 6.61 |
| 08/08/2014 20:30:31 | 23.70 | 310    | 6.83 | 08/09/2014 08:00:32 | 22.99 | 338 | 6.60 |
| 08/08/2014 20:45:32 | 23.69 | 310    | 6.81 | 08/09/2014 08:15:32 | 22.98 | 338 | 6.60 |
| 08/08/2014 21:00:31 | 23.69 | 311    | 6.80 | 08/09/2014 08:30:32 | 22.96 | 339 | 6.60 |
| 08/08/2014 21:15:31 | 23.68 | 312    | 6.78 | 08/09/2014 08:45:32 | 22.96 | 339 | 6.59 |
| 08/08/2014 21:30:32 | 23.67 | 312    | 6.77 | 08/09/2014 09:00:31 | 22.94 | 340 | 6.61 |
| 08/08/2014 21:45:31 | 23.66 | 313    | 6.76 | 08/09/2014 09:15:31 | 22.95 | 341 | 6.62 |
| 08/08/2014 22:00:31 | 23.64 | 314    | 6.76 | 08/09/2014 09:30:31 | 22.96 | 341 | 6.61 |
| 08/08/2014 22:15:31 | 23.63 | 314    | 6.73 | 08/09/2014 09:45:32 | 22.97 | 342 | 6.63 |
| 08/08/2014 22:30:31 | 23.61 | 315    | 6.72 | 08/09/2014 10:00:31 | 22.97 | 343 | 6.64 |
| 08/08/2014 22:45:32 | 23.60 | 316    | 6.72 | 08/09/2014 10:15:32 | 23.00 | 343 | 6.65 |
| 08/08/2014 23:00:32 | 23.59 | 316    | 6.70 | 08/09/2014 10:30:31 | 23.01 | 344 | 6.67 |
| 08/08/2014 23:15:32 | 23.57 | 317    | 6.70 | 08/09/2014 10:45:32 | 23.03 | 345 | 6.68 |
| 08/08/2014 23:30:32 | 23.55 | 318    | 6.69 | 08/09/2014 11:00:32 | 23.05 | 346 | 6.70 |
| 08/08/2014 23:45:32 | 23.54 | 319    | 6.68 | 08/09/2014 11:15:31 | 23.10 | 347 | 6.73 |
| 08/09/2014 00:00:32 | 23.52 | 319    | 6.68 | 08/09/2014 11:30:31 | 23.18 | 348 | 6.76 |
| 08/09/2014 00:15:32 | 23.51 | 320    | 6.64 | 08/09/2014 11:45:32 | 23.22 | 348 | 6.78 |
| 08/09/2014 00:30:31 | 23.50 | 321    | 6.65 | 08/09/2014 12:00:32 | 23.25 | 350 | 6.80 |
| 08/09/2014 00:45:31 | 23.49 | 321    | 6.66 | 08/09/2014 12:15:31 | 23.37 | 351 | 6.80 |
| 08/09/2014 01:00:32 | 23.47 | 322    | 6.66 | 08/09/2014 12:30:32 | 23.37 | 351 | 6.81 |
| 08/09/2014 01:15:32 | 23.46 | 323    | 6.67 | 08/09/2014 12:45:32 | 23.36 | 352 | 6.83 |
| 08/09/2014 01:30:32 | 23.44 | 323    | 6.66 | 08/09/2014 13:00:32 | 23.35 | 353 | 6.83 |
|                     |       |        |      | 08/09/2014 13:15:32 | 23.35 | 354 | 6.81 |
|                     |       |        |      | 08/09/2014 13:30:32 | 23.39 | 354 | 6.84 |
|                     |       |        |      | 08/09/2014 13:45:32 | 23.45 | 355 | 6.89 |

|                     |       |     |      |                     |       |     |      |
|---------------------|-------|-----|------|---------------------|-------|-----|------|
| 08/09/2014 14:00:32 | 23.51 | 356 | 6.89 | 08/10/2014 02:30:31 | 23.60 | 364 | 6.55 |
| 08/09/2014 14:15:32 | 23.55 | 356 | 6.94 | 08/10/2014 02:45:32 | 23.58 | 364 | 6.58 |
| 08/09/2014 14:30:31 | 23.71 | 357 | 6.97 | 08/10/2014 03:00:32 | 23.56 | 365 | 6.55 |
| 08/09/2014 14:45:32 | 23.87 | 358 | 7.00 | 08/10/2014 03:15:32 | 23.54 | 365 | 6.54 |
| 08/09/2014 15:00:32 | 23.96 | 358 | 7.03 | 08/10/2014 03:30:32 | 23.53 | 366 | 6.53 |
| 08/09/2014 15:15:31 | 24.06 | 359 | 7.06 | 08/10/2014 03:45:32 | 23.52 | 367 | 6.51 |
| 08/09/2014 15:30:31 | 24.15 | 360 | 7.08 | 08/10/2014 04:00:32 | 23.50 | 367 | 6.51 |
| 08/09/2014 15:45:32 | 24.27 | 360 | 7.08 | 08/10/2014 04:15:31 | 23.49 | 367 | 6.49 |
| 08/09/2014 16:00:32 | 24.34 | 360 | 7.12 | 08/10/2014 04:30:32 | 23.48 | 368 | 6.49 |
| 08/09/2014 16:15:31 | 24.39 | 361 | 7.12 | 08/10/2014 04:45:32 | 23.46 | 368 | 6.50 |
| 08/09/2014 16:30:31 | 24.41 | 361 | 7.14 | 08/10/2014 05:00:32 | 23.45 | 369 | 6.46 |
| 08/09/2014 16:45:31 | 24.43 | 362 | 7.15 | 08/10/2014 05:15:31 | 23.43 | 370 | 6.46 |
| 08/09/2014 17:00:31 | 24.43 | 362 | 7.10 | 08/10/2014 05:30:32 | 23.42 | 370 | 6.44 |
| 08/09/2014 17:15:31 | 24.43 | 362 | 7.11 | 08/10/2014 05:45:32 | 23.41 | 371 | 6.44 |
| 08/09/2014 17:30:32 | 24.43 | 363 | 7.12 | 08/10/2014 06:00:32 | 23.39 | 371 | 6.43 |
| 08/09/2014 17:45:32 | 24.44 | 363 | 7.09 | 08/10/2014 06:15:31 | 23.39 | 372 | 6.40 |
| 08/09/2014 18:00:31 | 24.44 | 363 | 7.11 | 08/10/2014 06:30:31 | 23.38 | 373 | 6.43 |
| 08/09/2014 18:15:31 | 24.46 | 363 | 7.08 | 08/10/2014 06:45:32 | 23.37 | 373 | 6.40 |
| 08/09/2014 18:30:31 | 24.47 | 363 | 7.10 | 08/10/2014 07:00:32 | 23.36 | 374 | 6.43 |
| 08/09/2014 18:45:31 | 24.47 | 363 | 7.08 | 08/10/2014 07:15:32 | 23.35 | 375 | 6.42 |
| 08/09/2014 19:00:32 | 24.46 | 363 | 7.06 | 08/10/2014 07:30:32 | 23.35 | 375 | 6.41 |
| 08/09/2014 19:15:31 | 24.45 | 363 | 7.06 | 08/10/2014 07:45:32 | 23.34 | 376 | 6.40 |
| 08/09/2014 19:30:32 | 24.43 | 363 | 7.04 | 08/10/2014 08:00:32 | 23.34 | 377 | 6.41 |
| 08/09/2014 19:45:31 | 24.40 | 363 | 7.00 | 08/10/2014 08:15:31 | 23.34 | 378 | 6.41 |
| 08/09/2014 20:00:32 | 24.37 | 363 | 7.02 | 08/10/2014 08:30:32 | 23.35 | 378 | 6.44 |
| 08/09/2014 20:15:32 | 24.35 | 363 | 7.00 | 08/10/2014 08:45:32 | 23.37 | 379 | 6.45 |
| 08/09/2014 20:30:31 | 24.31 | 363 | 6.98 | 08/10/2014 09:00:32 | 23.37 | 380 | 6.47 |
| 08/09/2014 20:45:31 | 24.27 | 363 | 6.95 | 08/10/2014 09:15:32 | 23.41 | 381 | 6.47 |
| 08/09/2014 21:00:31 | 24.24 | 363 | 6.92 | 08/10/2014 09:30:32 | 23.42 | 381 | 6.50 |
| 08/09/2014 21:15:31 | 24.20 | 362 | 6.90 | 08/10/2014 09:45:32 | 23.44 | 382 | 6.52 |
| 08/09/2014 21:30:31 | 24.17 | 363 | 6.87 | 08/10/2014 10:00:32 | 23.48 | 383 | 6.54 |
| 08/09/2014 21:45:31 | 24.13 | 362 | 6.85 | 08/10/2014 10:15:32 | 23.54 | 384 | 6.57 |
| 08/09/2014 22:00:32 | 24.10 | 362 | 6.83 | 08/10/2014 10:30:32 | 23.59 | 385 | 6.59 |
| 08/09/2014 22:15:32 | 24.07 | 362 | 6.83 | 08/10/2014 10:45:32 | 23.63 | 386 | 6.62 |
| 08/09/2014 22:30:31 | 24.03 | 362 | 6.80 | 08/10/2014 11:00:31 | 23.72 | 386 | 6.68 |
| 08/09/2014 22:45:32 | 24.00 | 362 | 6.80 | 08/10/2014 11:15:32 | 23.87 | 387 | 6.71 |
| 08/09/2014 23:00:32 | 23.97 | 362 | 6.76 | 08/10/2014 11:30:32 | 23.97 | 388 | 6.76 |
| 08/09/2014 23:15:32 | 23.93 | 362 | 6.74 | 08/10/2014 11:45:32 | 24.06 | 389 | 6.78 |
| 08/09/2014 23:30:32 | 23.90 | 362 | 6.72 | 08/10/2014 12:00:32 | 24.09 | 389 | 6.78 |
| 08/09/2014 23:45:31 | 23.87 | 362 | 6.74 | 08/10/2014 12:15:31 | 24.13 | 390 | 6.81 |
| 08/10/2014 00:00:32 | 23.83 | 362 | 6.72 | 08/10/2014 12:30:32 | 24.19 | 391 | 6.84 |
| 08/10/2014 00:15:32 | 23.80 | 362 | 6.72 | 08/10/2014 12:45:32 | 24.22 | 391 | 6.86 |
| 08/10/2014 00:30:31 | 23.77 | 362 | 6.69 | 08/10/2014 13:00:31 | 24.22 | 392 | 6.86 |
| 08/10/2014 00:45:32 | 23.75 | 362 | 6.67 | 08/10/2014 13:15:31 | 24.31 | 393 | 6.94 |
| 08/10/2014 01:00:32 | 23.72 | 362 | 6.65 | 08/10/2014 13:30:31 | 24.45 | 394 | 6.95 |
| 08/10/2014 01:15:31 | 23.71 | 363 | 6.64 | 08/10/2014 13:45:32 | 24.60 | 394 | 7.01 |
| 08/10/2014 01:30:32 | 23.68 | 363 | 6.63 | 08/10/2014 14:00:32 | 24.67 | 395 | 7.08 |
| 08/10/2014 01:45:32 | 23.66 | 363 | 6.62 | 08/10/2014 14:15:31 | 24.67 | 396 | 7.09 |
| 08/10/2014 02:00:32 | 23.64 | 363 | 6.61 | 08/10/2014 14:30:31 | 24.67 | 396 | 7.10 |
| 08/10/2014 02:15:31 | 23.62 | 364 | 6.57 | 08/10/2014 14:45:31 | 24.72 | 397 | 7.13 |

|                     |       |     |      |                     |       |     |      |
|---------------------|-------|-----|------|---------------------|-------|-----|------|
| 08/10/2014 15:00:31 | 24.74 | 397 | 7.11 | 08/11/2014 03:30:32 | 23.71 | 418 | 6.59 |
| 08/10/2014 15:15:31 | 24.76 | 398 | 7.16 | 08/11/2014 03:45:31 | 23.67 | 418 | 6.58 |
| 08/10/2014 15:30:32 | 24.81 | 399 | 7.16 | 08/11/2014 04:00:32 | 23.64 | 418 | 6.55 |
| 08/10/2014 15:45:32 | 24.83 | 399 | 7.22 | 08/11/2014 04:15:32 | 23.60 | 418 | 6.58 |
| 08/10/2014 16:00:31 | 24.84 | 400 | 7.22 | 08/11/2014 04:30:32 | 23.57 | 419 | 6.58 |
| 08/10/2014 16:15:31 | 24.85 | 400 | 7.21 | 08/11/2014 04:45:32 | 23.53 | 419 | 6.55 |
| 08/10/2014 16:30:31 | 24.86 | 401 | 7.21 | 08/11/2014 05:00:32 | 23.50 | 419 | 6.55 |
| 08/10/2014 16:45:32 | 24.86 | 401 | 7.20 | 08/11/2014 05:15:32 | 23.48 | 419 | 6.51 |
| 08/10/2014 17:00:32 | 24.85 | 402 | 7.20 | 08/11/2014 05:30:32 | 23.46 | 420 | 6.52 |
| 08/10/2014 17:15:31 | 24.86 | 402 | 7.18 | 08/11/2014 05:45:32 | 23.43 | 420 | 6.52 |
| 08/10/2014 17:30:31 | 24.88 | 403 | 7.23 | 08/11/2014 06:00:32 | 23.40 | 420 | 6.54 |
| 08/10/2014 17:45:31 | 24.90 | 403 | 7.21 | 08/11/2014 06:15:32 | 23.38 | 420 | 6.47 |
| 08/10/2014 18:00:31 | 24.91 | 403 | 7.24 | 08/11/2014 06:30:31 | 23.36 | 421 | 6.50 |
| 08/10/2014 18:15:32 | 24.91 | 404 | 7.21 | 08/11/2014 06:45:32 | 23.34 | 421 | 6.51 |
| 08/10/2014 18:30:31 | 24.91 | 404 | 7.20 | 08/11/2014 07:00:32 | 23.32 | 421 | 6.47 |
| 08/10/2014 18:45:31 | 24.89 | 405 | 7.20 | 08/11/2014 07:15:32 | 23.31 | 421 | 6.48 |
| 08/10/2014 19:00:32 | 24.86 | 405 | 7.17 | 08/11/2014 07:30:32 | 23.30 | 422 | 6.47 |
| 08/10/2014 19:15:32 | 24.83 | 406 | 7.15 | 08/11/2014 07:45:32 | 23.30 | 422 | 6.47 |
| 08/10/2014 19:30:31 | 24.79 | 406 | 7.12 | 08/11/2014 08:00:32 | 23.30 | 422 | 6.53 |
| 08/10/2014 19:45:32 | 24.76 | 407 | 7.09 | 08/11/2014 08:15:31 | 23.29 | 422 | 6.52 |
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| 08/11/2014 02:00:32 | 23.94 | 416 | 6.65 | 08/11/2014 14:30:31 | 25.56 | 429 | 7.62 |
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| 08/11/2014 18:45:31 | 26.01 | 436 | 7.68 | 08/12/2014 07:15:32 | 23.16 | 447 | 6.36 |
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| 08/12/2014 20:15:32 | 25.01 | 455 | 7.82 | 08/13/2014 08:45:32 | 22.14 | 461 | 6.50 |
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| 08/13/2014 20:45:31 | 24.82 | 468 | 7.92 | 08/14/2014 09:15:32 | 22.05 | 469 | 6.81 |
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| 08/13/2014 23:30:32 | 24.03 | 468 | 7.40 |                     |       |     |      |
| 08/13/2014 23:45:32 | 23.96 | 468 | 7.36 |                     |       |     |      |
| 08/14/2014 00:00:32 | 23.89 | 468 | 7.33 |                     |       |     |      |
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| 08/14/2014 02:45:31 | 23.21 | 468 | 7.05 |                     |       |     |      |
| 08/14/2014 03:00:32 | 23.15 | 468 | 7.02 |                     |       |     |      |
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| 08/14/2014 04:00:31 | 22.92 | 468 | 6.96 |                     |       |     |      |
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| 08/14/2014 05:00:32 | 22.67 | 468 | 6.85 |                     |       |     |      |
| 08/14/2014 05:15:32 | 22.61 | 468 | 6.86 |                     |       |     |      |
| 08/14/2014 05:30:32 | 22.54 | 468 | 6.80 |                     |       |     |      |
| 08/14/2014 05:45:32 | 22.48 | 468 | 6.82 |                     |       |     |      |
| 08/14/2014 06:00:32 | 22.42 | 468 | 6.81 |                     |       |     |      |
| 08/14/2014 06:15:31 | 22.37 | 469 | 6.78 |                     |       |     |      |

**Dardenne Station 3 data sonde data:**

| Date M/D/Y<br>Time HH:MM:SS | Temp<br>C | SpCond<br>uS | DO<br>mg/L |                     |       |     |      |
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| 08/12/2014 00:00:33 | 25.07 | 404 | 5.61 | 08/12/2014 12:30:33 | 24.36 | 409 | 7.34 |
| 08/12/2014 00:15:33 | 24.97 | 404 | 5.53 | 08/12/2014 12:45:33 | 24.53 | 410 | 7.51 |
| 08/12/2014 00:30:33 | 24.87 | 405 | 5.46 | 08/12/2014 13:00:33 | 24.73 | 410 | 7.58 |
| 08/12/2014 00:45:33 | 24.78 | 405 | 5.42 | 08/12/2014 13:15:33 | 25.01 | 410 | 7.76 |
| 08/12/2014 01:00:33 | 24.70 | 405 | 5.43 | 08/12/2014 13:30:33 | 25.29 | 410 | 7.69 |
| 08/12/2014 01:15:33 | 24.60 | 405 | 5.37 | 08/12/2014 13:45:33 | 25.49 | 410 | 7.80 |
| 08/12/2014 01:30:33 | 24.51 | 406 | 5.29 | 08/12/2014 14:00:33 | 25.54 | 410 | 7.82 |
| 08/12/2014 01:45:33 | 24.42 | 406 | 5.26 | 08/12/2014 14:15:33 | 25.68 | 410 | 7.88 |
| 08/12/2014 02:00:33 | 24.32 | 406 | 5.23 | 08/12/2014 14:30:33 | 25.82 | 410 | 8.11 |
| 08/12/2014 02:15:33 | 24.23 | 406 | 5.20 | 08/12/2014 14:45:33 | 26.04 | 410 | 8.10 |
| 08/12/2014 02:30:33 | 24.14 | 406 | 5.21 | 08/12/2014 15:00:33 | 26.16 | 410 | 8.14 |
| 08/12/2014 02:45:33 | 24.07 | 407 | 5.14 | 08/12/2014 15:15:33 | 26.34 | 410 | 8.15 |
| 08/12/2014 03:00:33 | 23.98 | 407 | 5.12 | 08/12/2014 15:30:33 | 26.45 | 409 | 8.20 |
| 08/12/2014 03:15:33 | 23.89 | 407 | 5.13 | 08/12/2014 15:45:33 | 26.34 | 411 | 8.24 |
| 08/12/2014 03:30:33 | 23.79 | 407 | 5.09 | 08/12/2014 16:00:33 | 26.50 | 410 | 8.33 |
| 08/12/2014 03:45:33 | 23.71 | 407 | 5.03 | 08/12/2014 16:15:33 | 26.49 | 410 | 8.28 |
| 08/12/2014 04:00:33 | 23.62 | 407 | 5.07 | 08/12/2014 16:30:33 | 26.50 | 411 | 8.23 |
| 08/12/2014 04:15:33 | 23.53 | 407 | 5.03 | 08/12/2014 16:45:33 | 26.53 | 410 | 8.26 |
| 08/12/2014 04:30:33 | 23.46 | 407 | 5.02 | 08/12/2014 17:00:33 | 26.48 | 411 | 8.12 |
| 08/12/2014 04:45:33 | 23.37 | 409 | 4.98 | 08/12/2014 17:15:33 | 26.42 | 411 | 7.98 |
| 08/12/2014 05:00:33 | 23.27 | 408 | 5.03 | 08/12/2014 17:30:33 | 26.41 | 411 | 8.11 |
| 08/12/2014 05:15:33 | 23.21 | 408 | 4.95 | 08/12/2014 17:45:33 | 26.32 | 411 | 7.91 |
| 08/12/2014 05:30:33 | 23.12 | 408 | 4.96 | 08/12/2014 18:00:33 | 26.25 | 411 | 7.86 |

|                     |       |     |      |                     |       |     |      |
|---------------------|-------|-----|------|---------------------|-------|-----|------|
| 08/12/2014 18:15:33 | 26.15 | 411 | 7.71 | 08/13/2014 06:45:33 | 21.69 | 417 | 4.73 |
| 08/12/2014 18:30:33 | 26.13 | 411 | 7.76 | 08/13/2014 07:00:33 | 21.62 | 417 | 4.76 |
| 08/12/2014 18:45:33 | 26.06 | 411 | 7.64 | 08/13/2014 07:15:33 | 21.55 | 417 | 4.74 |
| 08/12/2014 19:00:33 | 25.92 | 411 | 7.30 | 08/13/2014 07:30:33 | 21.50 | 417 | 4.71 |
| 08/12/2014 19:15:33 | 25.87 | 411 | 7.51 | 08/13/2014 07:45:33 | 21.44 | 417 | 4.79 |
| 08/12/2014 19:30:33 | 25.72 | 411 | 7.31 | 08/13/2014 08:00:33 | 21.41 | 417 | 4.78 |
| 08/12/2014 19:45:33 | 25.62 | 411 | 7.34 | 08/13/2014 08:15:33 | 21.39 | 417 | 4.82 |
| 08/12/2014 20:00:33 | 25.49 | 412 | 7.13 | 08/13/2014 08:30:33 | 21.42 | 417 | 4.86 |
| 08/12/2014 20:15:33 | 25.38 | 412 | 7.00 | 08/13/2014 08:45:33 | 21.48 | 418 | 4.92 |
| 08/12/2014 20:30:33 | 25.26 | 412 | 6.88 | 08/13/2014 09:00:33 | 21.56 | 417 | 5.07 |
| 08/12/2014 20:45:33 | 25.16 | 412 | 6.93 | 08/13/2014 09:15:33 | 21.68 | 417 | 5.04 |
| 08/12/2014 21:00:33 | 25.04 | 412 | 6.75 | 08/13/2014 09:30:33 | 21.77 | 417 | 5.15 |
| 08/12/2014 21:15:33 | 24.92 | 412 | 6.62 | 08/13/2014 09:45:33 | 21.87 | 416 | 5.23 |
| 08/12/2014 21:30:33 | 24.82 | 412 | 6.62 | 08/13/2014 10:00:33 | 22.03 | 417 | 5.39 |
| 08/12/2014 21:45:33 | 24.70 | 413 | 6.46 | 08/13/2014 10:15:33 | 22.18 | 417 | 5.59 |
| 08/12/2014 22:00:33 | 24.60 | 413 | 6.49 | 08/13/2014 10:30:33 | 22.38 | 417 | 5.71 |
| 08/12/2014 22:15:33 | 24.48 | 413 | 6.34 | 08/13/2014 10:45:33 | 22.57 | 417 | 5.89 |
| 08/12/2014 22:30:33 | 24.39 | 413 | 6.22 | 08/13/2014 11:00:33 | 22.79 | 417 | 6.06 |
| 08/12/2014 22:45:33 | 24.28 | 412 | 6.29 | 08/13/2014 11:15:33 | 22.98 | 416 | 6.09 |
| 08/12/2014 23:00:33 | 24.18 | 413 | 6.07 | 08/13/2014 11:30:33 | 23.14 | 416 | 6.06 |
| 08/12/2014 23:15:33 | 24.08 | 413 | 6.09 | 08/13/2014 11:45:33 | 23.28 | 416 | 6.24 |
| 08/12/2014 23:30:33 | 23.97 | 413 | 6.05 | 08/13/2014 12:00:33 | 23.41 | 416 | 6.34 |
| 08/12/2014 23:45:33 | 23.89 | 413 | 5.96 | 08/13/2014 12:15:33 | 23.57 | 417 | 6.67 |
| 08/13/2014 00:00:33 | 23.79 | 413 | 5.89 | 08/13/2014 12:30:33 | 23.68 | 417 | 6.83 |
| 08/13/2014 00:15:33 | 23.70 | 413 | 5.80 | 08/13/2014 12:45:33 | 23.79 | 418 | 6.98 |
| 08/13/2014 00:30:33 | 23.60 | 413 | 5.78 | 08/13/2014 13:00:33 | 23.91 | 418 | 7.07 |
| 08/13/2014 00:45:33 | 23.52 | 414 | 5.68 | 08/13/2014 13:15:33 | 24.06 | 418 | 7.11 |
| 08/13/2014 01:00:33 | 23.41 | 414 | 5.69 | 08/13/2014 13:30:33 | 24.25 | 418 | 7.24 |
| 08/13/2014 01:15:33 | 23.32 | 414 | 5.58 | 08/13/2014 13:45:33 | 24.44 | 418 | 7.29 |
| 08/13/2014 01:30:33 | 23.24 | 414 | 5.59 | 08/13/2014 14:00:33 | 24.63 | 418 | 7.40 |
| 08/13/2014 01:45:33 | 23.17 | 414 | 5.44 | 08/13/2014 14:15:33 | 24.85 | 418 | 7.44 |
| 08/13/2014 02:00:33 | 23.09 | 415 | 5.36 | 08/13/2014 14:30:33 | 24.89 | 419 | 7.57 |
| 08/13/2014 02:15:33 | 23.00 | 415 | 5.32 | 08/13/2014 14:45:33 | 25.09 | 419 | 7.43 |
| 08/13/2014 02:30:33 | 22.89 | 415 | 5.31 | 08/13/2014 15:00:33 | 25.35 | 418 | 7.56 |
| 08/13/2014 02:45:33 | 22.85 | 415 | 5.21 | 08/13/2014 15:15:33 | 25.55 | 418 | 7.54 |
| 08/13/2014 03:00:33 | 22.75 | 415 | 5.23 | 08/13/2014 15:30:33 | 25.75 | 417 | 7.50 |
| 08/13/2014 03:15:33 | 22.66 | 415 | 5.16 | 08/13/2014 15:45:33 | 25.72 | 418 | 7.64 |
| 08/13/2014 03:30:33 | 22.63 | 415 | 5.02 | 08/13/2014 16:00:33 | 25.51 | 420 | 7.49 |
| 08/13/2014 03:45:33 | 22.51 | 415 | 5.11 | 08/13/2014 16:15:33 | 25.55 | 419 | 7.42 |
| 08/13/2014 04:00:33 | 22.43 | 416 | 5.06 | 08/13/2014 16:30:33 | 25.61 | 419 | 7.31 |
| 08/13/2014 04:15:33 | 22.38 | 416 | 4.96 | 08/13/2014 16:45:33 | 25.86 | 419 | 7.71 |
| 08/13/2014 04:30:33 | 22.28 | 416 | 5.03 | 08/13/2014 17:00:33 | 25.92 | 419 | 7.49 |
| 08/13/2014 04:45:33 | 22.24 | 416 | 4.93 | 08/13/2014 17:15:33 | 25.74 | 419 | 7.05 |
| 08/13/2014 05:00:33 | 22.15 | 416 | 4.91 | 08/13/2014 17:30:33 | 25.91 | 419 | 7.15 |
| 08/13/2014 05:15:33 | 22.08 | 416 | 4.92 | 08/13/2014 17:45:33 | 25.91 | 419 | 7.44 |
| 08/13/2014 05:30:33 | 22.02 | 417 | 4.86 | 08/13/2014 18:00:33 | 25.77 | 420 | 6.40 |
| 08/13/2014 05:45:33 | 21.93 | 416 | 4.86 | 08/13/2014 18:15:33 | 25.84 | 420 | 7.22 |
| 08/13/2014 06:00:33 | 21.86 | 417 | 4.83 | 08/13/2014 18:30:33 | 25.82 | 420 | 7.12 |
| 08/13/2014 06:15:33 | 21.80 | 417 | 4.76 | 08/13/2014 18:45:33 | 25.77 | 419 | 7.18 |
| 08/13/2014 06:30:33 | 21.75 | 417 | 4.74 | 08/13/2014 19:00:33 | 25.67 | 419 | 7.02 |

|                     |       |     |      |                     |       |     |      |
|---------------------|-------|-----|------|---------------------|-------|-----|------|
| 08/13/2014 19:15:33 | 25.49 | 422 | 6.61 | 08/14/2014 07:45:33 | 21.29 | 423 | 4.58 |
| 08/13/2014 19:30:33 | 25.43 | 422 | 6.63 | 08/14/2014 08:00:33 | 21.25 | 423 | 4.62 |
| 08/13/2014 19:45:33 | 25.42 | 422 | 7.01 | 08/14/2014 08:15:33 | 21.24 | 423 | 4.63 |
| 08/13/2014 20:00:33 | 25.27 | 422 | 6.84 | 08/14/2014 08:30:33 | 21.24 | 423 | 4.63 |
| 08/13/2014 20:15:33 | 25.20 | 421 | 6.86 | 08/14/2014 08:45:33 | 21.28 | 423 | 4.69 |
| 08/13/2014 20:30:33 | 25.10 | 421 | 6.58 | 08/14/2014 09:00:33 | 21.37 | 423 | 4.71 |
| 08/13/2014 20:45:33 | 24.94 | 422 | 6.41 | 08/14/2014 09:15:33 | 21.46 | 422 | 4.72 |
| 08/13/2014 21:00:33 | 24.81 | 422 | 6.09 | 08/14/2014 09:30:33 | 21.63 | 422 | 4.69 |
| 08/13/2014 21:15:33 | 24.72 | 421 | 6.17 | 08/14/2014 09:45:33 | 21.78 | 421 | 4.79 |
| 08/13/2014 21:30:33 | 24.64 | 421 | 6.11 | 08/14/2014 10:00:33 | 21.96 | 422 | 4.87 |
| 08/13/2014 21:45:33 | 24.53 | 421 | 5.84 | 08/14/2014 10:15:33 | 22.05 | 421 | 4.96 |
| 08/13/2014 22:00:33 | 24.41 | 422 | 5.54 | 08/14/2014 10:30:33 | 22.30 | 422 | 5.20 |
| 08/13/2014 22:15:33 | 24.32 | 422 | 5.72 | 08/14/2014 10:45:33 | 22.50 | 420 | 5.28 |
| 08/13/2014 22:30:33 | 24.23 | 422 | 5.40 | 08/14/2014 11:00:33 | 22.72 | 420 | 5.46 |
| 08/13/2014 22:45:33 | 24.15 | 421 | 5.82 |                     |       |     |      |
| 08/13/2014 23:00:33 | 24.06 | 421 | 5.76 |                     |       |     |      |
| 08/13/2014 23:15:33 | 23.96 | 422 | 5.61 |                     |       |     |      |
| 08/13/2014 23:30:33 | 23.87 | 422 | 5.69 |                     |       |     |      |
| 08/13/2014 23:45:33 | 23.78 | 421 | 5.77 |                     |       |     |      |
| 08/14/2014 00:00:33 | 23.69 | 421 | 5.65 |                     |       |     |      |
| 08/14/2014 00:15:33 | 23.60 | 421 | 5.65 |                     |       |     |      |
| 08/14/2014 00:30:33 | 23.49 | 421 | 5.63 |                     |       |     |      |
| 08/14/2014 00:45:33 | 23.42 | 422 | 5.49 |                     |       |     |      |
| 08/14/2014 01:00:33 | 23.30 | 421 | 5.58 |                     |       |     |      |
| 08/14/2014 01:15:33 | 23.21 | 421 | 5.54 |                     |       |     |      |
| 08/14/2014 01:30:33 | 23.13 | 421 | 5.47 |                     |       |     |      |
| 08/14/2014 01:45:33 | 23.05 | 421 | 5.42 |                     |       |     |      |
| 08/14/2014 02:00:33 | 22.96 | 421 | 5.38 |                     |       |     |      |
| 08/14/2014 02:15:33 | 22.87 | 421 | 5.33 |                     |       |     |      |
| 08/14/2014 02:30:33 | 22.79 | 421 | 5.29 |                     |       |     |      |
| 08/14/2014 02:45:33 | 22.69 | 421 | 5.27 |                     |       |     |      |
| 08/14/2014 03:00:33 | 22.60 | 421 | 5.26 |                     |       |     |      |
| 08/14/2014 03:15:33 | 22.53 | 421 | 5.17 |                     |       |     |      |
| 08/14/2014 03:30:33 | 22.45 | 421 | 5.16 |                     |       |     |      |
| 08/14/2014 03:45:33 | 22.38 | 421 | 5.11 |                     |       |     |      |
| 08/14/2014 04:00:33 | 22.31 | 422 | 5.06 |                     |       |     |      |
| 08/14/2014 04:15:33 | 22.23 | 421 | 5.02 |                     |       |     |      |
| 08/14/2014 04:30:33 | 22.16 | 422 | 4.99 |                     |       |     |      |
| 08/14/2014 04:45:33 | 22.07 | 422 | 4.92 |                     |       |     |      |
| 08/14/2014 05:00:33 | 21.99 | 422 | 4.86 |                     |       |     |      |
| 08/14/2014 05:15:33 | 21.95 | 422 | 4.83 |                     |       |     |      |
| 08/14/2014 05:30:33 | 21.86 | 422 | 4.83 |                     |       |     |      |
| 08/14/2014 05:45:33 | 21.80 | 422 | 4.79 |                     |       |     |      |
| 08/14/2014 06:00:33 | 21.70 | 422 | 4.78 |                     |       |     |      |
| 08/14/2014 06:15:33 | 21.65 | 422 | 4.74 |                     |       |     |      |
| 08/14/2014 06:30:33 | 21.61 | 423 | 4.67 |                     |       |     |      |
| 08/14/2014 06:45:33 | 21.52 | 423 | 4.66 |                     |       |     |      |
| 08/14/2014 07:00:33 | 21.44 | 423 | 4.62 |                     |       |     |      |
| 08/14/2014 07:15:33 | 21.41 | 423 | 4.63 |                     |       |     |      |
| 08/14/2014 07:30:33 | 21.33 | 423 | 4.63 |                     |       |     |      |

Appendix C  
Kruskal-Wallis One Way ANOVA Results



# One Way Analysis of Variance

Friday, September 09, 2016, 9:32:41 AM

**Data source:** Data 1 in Dardenne Fine Sediment Notebook 1.SNB

Dependent Variable: Percent Fine Sediment

**Normality Test:** Failed (P < 0.050)

**Equal Variance Test:** Passed (P = 0.545)

| Group Name | N   | Missing | Mean   | Std Dev | SEM   |
|------------|-----|---------|--------|---------|-------|
| CONT       | 144 | 0       | 34.316 | 33.376  | 2.781 |
| DC1        | 18  | 0       | 76.417 | 22.228  | 5.239 |
| DC2        | 18  | 0       | 53.361 | 27.110  | 6.390 |
| DC3        | 18  | 0       | 69.472 | 28.695  | 6.763 |
| DC4        | 18  | 0       | 78.667 | 29.445  | 6.940 |
| DC4.1      | 18  | 0       | 59.278 | 31.825  | 7.501 |
| DC4.9      | 18  | 0       | 56.139 | 36.289  | 8.553 |
| DC6.1      | 18  | 0       | 28.472 | 33.365  | 7.864 |

| Source of Variation | DF  | SS         | MS        | F      | P      |
|---------------------|-----|------------|-----------|--------|--------|
| Between Groups      | 7   | 76917.480  | 10988.211 | 10.764 | <0.001 |
| Residual            | 262 | 267452.887 | 1020.813  |        |        |
| Total               | 269 | 344370.367 |           |        |        |

The differences in the mean values among the treatment groups are greater than would be expected by chance; there is a statistically significant difference (P = <0.001).

Power of performed test with alpha = 0.050: 1.000

Multiple Comparisons versus Control Group (Holm-Sidak method):  
Overall significance level = 0.05

Comparisons for factor: **Col 2**

| Comparison     | Diff of Means | t     | Unadjusted P | Critical Level | Significant? |
|----------------|---------------|-------|--------------|----------------|--------------|
| CONT vs. DC4   | 44.351        | 5.552 | 0.0000000690 | 0.007          | Yes          |
| CONT vs. DC1   | 42.101        | 5.271 | 0.000000284  | 0.009          | Yes          |
| CONT vs. DC3   | 35.156        | 4.401 | 0.0000157    | 0.010          | Yes          |
| CONT vs. DC4.1 | 24.962        | 3.125 | 0.00198      | 0.013          | Yes          |
| CONT vs. DC4.9 | 21.823        | 2.732 | 0.00672      | 0.017          | Yes          |
| CONT vs. DC2   | 19.045        | 2.384 | 0.0178       | 0.025          | Yes          |
| CONT vs. DC6.1 | 5.844         | 0.732 | 0.465        | 0.050          | No           |

# **Kruskal-Wallis One Way Analysis of Variance on Ranks**

Friday, September 09, 2016, 9:27:08 AM

**Data source:** Data 1 in Notebook 1

Dependent Variable: Percent Fine Sediment

**Normality Test:** Failed (P < 0.050)

| Group | N   | Missing | Median | 25%    | 75%     |
|-------|-----|---------|--------|--------|---------|
| CONT  | 144 | 0       | 17.500 | 5.000  | 60.000  |
| DC1   | 18  | 0       | 86.250 | 60.000 | 92.500  |
| DC2   | 18  | 0       | 56.250 | 25.000 | 75.000  |
| DC3   | 18  | 0       | 70.000 | 42.500 | 100.000 |
| DC4   | 18  | 0       | 95.000 | 65.000 | 99.000  |
| DC4.1 | 18  | 0       | 65.000 | 40.000 | 90.000  |
| DC4.9 | 18  | 0       | 61.250 | 27.500 | 90.000  |
| DC6.1 | 18  | 0       | 12.500 | 5.000  | 55.000  |

H = 59.872 with 7 degrees of freedom. (P = <0.001)

The differences in the median values among the treatment groups are greater than would be expected by chance; there is a statistically significant difference (P = <0.001)

To isolate the group or groups that differ from the others use a multiple comparison procedure.

Multiple Comparisons versus Control Group (Dunn's Method):

| Comparison    | Diff of Ranks | Q     | P<0.05      |
|---------------|---------------|-------|-------------|
| DC4 vs CONT   | 96.073        | 4.921 | Yes         |
| DC1 vs CONT   | 87.545        | 4.485 | Yes         |
| DC3 vs CONT   | 79.823        | 4.089 | Yes         |
| DC4.1 vs CONT | 52.990        | 2.714 | Yes         |
| DC4.9 vs CONT | 47.851        | 2.451 | No          |
| DC2 vs CONT   | 46.212        | 2.367 | Do Not Test |
| DC6.1 vs CONT | 14.399        | 0.738 | Do Not Test |

Note: The multiple comparisons on ranks do not include an adjustment for ties.